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Cleanup Action Plan for the Quendall Terminals Property

Prepared for

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Acronyms and Abbreviations

AET	apparent effects threshold
ARAR	applicable or relevant and appropriate requirement
BTEX	benzene, toluene, ethylbenzene, and xylenes
CAP	Cleanup Action Plan
City	City of Renton
CoC	constituent of concern
DNAPL	dense, nonaqueous-phase liquid
DNS	Determination of Nonsignificance
Ecology	Washington State Department of Ecology
EIS	environmental impact statement
MTCA	Model Toxics Control Act
NAPL	nonaqueous-phase liquid
PAH	polycyclic aromatic hydrocarbon
PPA	Prospective Purchaser Agreement
PQL	practical quantification limit
RAO	remedial action objective
RI/FFS	remedial investigation and focused feasibility study
SEPA	State Environmental Policy Act
site	Quendall Terminals property
SMS	Sediment Management Standards

Executive Summary

This document presents the Cleanup Action Plan (CAP) for the Quendall Terminals property, a 23-acre parcel located on the eastern shore of Lake Washington in Renton, Washington. The property has had various industrial uses since the early 1900s and has been the subject of an extensive series of environmental investigations starting in 1971. These investigations have indicated that the property is heavily contaminated from coal tar refining activities that occurred there between 1917 and 1969. The contaminated areas include onsite soil and groundwater, areas of dense, nonaqueous-phase liquid (DNAPL), and the Lake Washington shoreline and sediments. Primary contaminants found at the site are polycyclic aromatic hydrocarbons (PAHs), benzene, DNAPL, and wood waste. The Washington State Department of Ecology (Ecology) has assigned the site a hazard ranking of 1.

Since the early 1970s, various parties have attempted to purchase, clean up, and redevelop the Quendall Terminals property; however, each of these efforts has proved unsuccessful because of the extensive contamination at the site, difficulties in addressing the environmental liabilities posed by the site, and the extensive infrastructure and geotechnical improvements required for site redevelopment. In light of certain unique opportunities offered by the location, size, and nature of the site, the City of Renton (City) recognized that the Quendall Terminals property could become an important and valuable asset to the citizens and a major revenue source to the City if cleaned up and redeveloped. As a result, the City has continued to work to develop an effective plan to restore the Quendall Terminals property to beneficial use for the community.

First, the Quendall Terminals property serves as a cornerstone for redevelopment of a much larger area that could include three other adjacent parcels offering redevelopment opportunities (i.e., the J.H. Baxter and Company property located to the north, the Barbee Mills property located to the south, and the Pan Abode property located to the southeast). In addition, the Quendall Terminals property and adjacent properties include unique

shoreline and nearshore habitat that contrasts sharply with the otherwise heavily developed nature of Lake Washington. This relatively undeveloped shoreline offers opportunities for enhancing natural habitat and permanent public shoreline access.

To take advantage of these opportunities, the City intends to enter into the Prospective Purchaser Agreement (PPA) process with Ecology to facilitate the remediation and redevelopment of the Quendall Terminals property. Under the proposed plan, the City would purchase the site from the current owners and remediate the site using funding from city, state, federal, and private sources. If the City is successful in managing the environmental risk at Quendall Terminals, future plans include providing permanent shoreline access through a waterfront park and selling the remaining upland portions of Quendall Terminals to a private developer for a mixed-use development.

The successful cleanup and redevelopment of the Quendall Terminals property will provide benefits to the citizens of the State of Washington and the City. These benefits include management of environmental risk at a site situated on a shoreline of statewide significance that has a hazard ranking of 1 on Ecology's Hazardous Sites List; creation of approximately 0.25 mile of permanent shoreline access for the public, with additional adjoining shoreline access possible at the adjacent sites; shoreline and lake-bottom habitat restoration that will benefit salmonids and other wildlife (including endangered species); and both direct and indirect economic benefits to the City and State.

This CAP provides necessary documentation to support the PPA and is based on the remedial investigation and focused feasibility study (RI/FFS) that has been prepared for the site. The RI/FFS summarizes existing information regarding site uses, characteristics, and conditions as derived from the extensive previous site investigations. In addition, the RI/FFS reviews the potential human health and environmental risks posed by the site, the qualitative and numerical remedial action objectives (RAOs) used to determine site cleanup requirements, and the remedial technologies identified to implement the cleanup goals. The CAP summarizes the necessary information describing the proposed cleanup for the site and will be included as an attachment to the PPA.

Based on the information compiled and analyzed in the RI/FFS and CAP, the following remedial actions were selected to address contamination at the site:

- To address contaminants in soil, the entire surface of the site will be covered by a 3-ft-thick clean soil cap or pavement, buildings, or other structures placed on the soil surface that would similarly prevent exposure to residual contaminants in soil. DNAPL-affected soil will also be excavated from selected areas of the site. This soil will be treated and returned to the excavations.

- To address contaminants in groundwater, two DNAPL recovery trenches will be installed and used to collect DNAPL for treatment. Institutional controls will also be established to prevent direct use of groundwater. Biosparging has also been selected as a contingent remedy if needed to achieve RAOs for groundwater.

- To address contaminants in sediments, the sediments and nearshore soil from several areas will be dredged and treated. These excavated areas will be backfilled with treated or clean materials. These areas include the vicinity of the T-dock where sediments are affected by PAH compounds and the nearshore area affected by a DNAPL seep. In addition, sediments containing more than 50 percent wood waste will be dredged. Because this action will restore the lake bottom to its approximate original contours, these areas will not be backfilled. Certain other sediments containing less than 50 percent wood waste may be covered with a cap of 1-ft maximum thickness, consisting of imported clean fill and/or treated sediments and soils. The extent of this cap will be determined based on toxicity testing that is currently scheduled for summer 2000.

Requirements for compliance sampling and ongoing monitoring and maintenance activities are also specified in the preferred remedial alternative described in the RI/FFS and CAP.

1. Introduction

1.1 Site History

The 23-acre Quendall Terminals property is located on the southeastern shore of Lake Washington in Renton, Washington, as shown in Figure 2-1. The site is heavily contaminated from the coal tar refining that occurred there from 1917 to 1969. The contaminated areas include onsite soils, onsite groundwater, areas of dense, nonaqueous-phase liquid (DNAPL), the Lake Washington shoreline, and Lake Washington sediments. Contaminants found onsite primarily consist of polycyclic aromatic hydrocarbons (PAH), benzene, DNAPL, and wood waste, and the site has a Washington State Department of Ecology (Ecology) hazard ranking of 1. The site is currently being used as a log sorting yard by a local lumber company.

1.2 Project Background

Since the early 1970s, various parties have attempted to purchase, clean up, and redevelop the Quendall Terminals property; however, each of these efforts has proved unsuccessful for at least the following three reasons:

- The extensive contamination at the site,
- An inability of the parties to reach agreement given the undefined liabilities posed by environmental remediation, and
- The need for extensive transportation infrastructure and geotechnical improvements in connection with redevelopment.

In light of certain unique opportunities offered by the location, size, and nature of the site, the City of Renton (City) recognized that the Quendall Terminals property could become an important and valuable asset to the citizens and a major revenue source to the City if cleaned up and redeveloped. As a result, the City has continued to work to develop an effective plan to restore the Quendall Terminals property to beneficial use for the community.

First, the Quendall Terminals property is located at the center of three other adjacent parcels offering redevelopment opportunities (i.e., the J.H. Baxter and Company property located to the north, the Barbee Mills property located to the south, and the Pan Abode property located to the southeast). Thus, the Quendall Terminals property serves as a cornerstone for redevelopment of a much larger area. In addition, the Quendall Terminals property and adjacent properties include unique shoreline and nearshore habitat that contrast sharply with the otherwise heavily developed nature of Lake Washington. This relatively undeveloped shoreline offers opportunities for enhancing natural habitat and permanent public shoreline access.

To take advantage of these opportunities, the City intends to enter into the Prospective Purchaser Agreement (PPA) process with Ecology to facilitate the remediation and redevelopment of the Quendall Terminals property. Under the proposed plan, the City would purchase the site from the current owners and remediate the site using funding from city, state, federal, and private sources. If the City is successful in managing the environmental risk at Quendall Terminals, future plans include providing permanent shoreline access through a waterfront park along the entire adjacent shoreline area and selling the remaining upland portions of Quendall Terminals to a private developer for a mixed-use development.

The successful cleanup and redevelopment of the Quendall Terminals property will provide benefits to the citizens of the State of Washington and the City. Foremost, the cleanup would yield management of environmental risk at a site that has a hazard ranking of 1 on Ecology's Hazardous Sites List and is situated on a shoreline of statewide

significance. Second, the cleanup and redevelopment would lead to the creation of approximately 0.25 miles of permanent shoreline access for the public, with additional adjoining shoreline access possible at the adjacent sites. This access would yield benefits to the region for the indefinite future. In addition, shoreline and lake-bottom habitat restoration will benefit salmonids and other wildlife and will contribute to the recovery of endangered species.

The economic benefits to the City and State governments include additional revenue from property taxes on any improvements, sales tax revenue from retail sales and hotels, and transportation taxes based on the number of full-time workers. In addition to the direct tax benefits, creation of a mixed-use development will provide economic benefit to the citizens through increased employment opportunities, increased business to local restaurants and shops, and increased property value of local residences resulting from improvements in the area.

The City has entered into a purchase and sale agreement with the current owners of Quendall Terminals. The agreement calls for the Quendall Terminals purchase to close, after completion of a PPA between the City and Ecology. After the property is purchased, the City will perform the cleanup and will comply with the Washington State Model Toxics Control Act (MTCA) by performing the actions described in the attachments to the PPA, which will include this Cleanup Action Plan (CAP).

1.3 Description of CAP

This CAP describes the selected remediation at the site, how the remedy was selected, how it is protective of human health and the environment, and how it complies with MTCA. As noted, this document will be included as an attachment to the MTCA PPA, cooperatively entered into by the City and Ecology.

The City has submitted this CAP with the understanding that no independent liabilities shall be assumed by the City under MTCA or any other comparable federal or state environmental laws should the City elect not to complete the purchase of the Quendall Terminals property. The current owners of the Quendall Terminals property have authorized this submittal without being committed to, or bound by, the content of this CAP.

This CAP describes the site, including a summary of its history and the extent of contamination; identifies site-specific cleanup standards; summarizes the remedial action alternatives presented in the remedial investigation and focused feasibility study (RI/FFS); identifies and describes the selected remedial action alternative for the site; justifies the selected alternative; and describes the implementation schedule. Detailed information regarding site history, characterization, and the evaluation of alternative cleanup actions is contained in the RI/FFS report for the site (Exponent 1999).

2. Site Description, History, and Summary of Environmental Conditions

2.1 Site Description

The Quendall Terminals property is a 23-acre site located on the eastern shore of Lake Washington at 4503 Lake Washington Boulevard, in the northernmost limits of Renton, Washington (Figure 2-1). The site is relatively flat and occupies the middle portion of a roughly 70-acre alluvial plain that borders approximately 4,000 ft of Lake Washington shoreline. Interstate 405 lies approximately 500 ft to the east. The property to the south is occupied by the Barbee Mill, and the property to the north is owned by J.H. Baxter (Figure 2-2).

2.2 Site History

The site was conveyed by deed to Peter Reilly in 1916, and the Reilly family began the Republic Creosoting Company. In 1956, Republic Creosoting Company became Reilly Tar and Chemical Corporation. The site was used for creosote manufacturing for 53 years until 1969. During its operation, the creosote manufacturing facility refined and processed tar residues. The tar residues were commonly shipped or barged to the site and pumped through transfer lines that ran along a former wharf and pipe trestle. The tar residues were then transferred to the still house (Figure 2-3) where they were refined, producing creosote and distillates. The products were stored in tanks until shipment by either rail, tanker truck, or ship. Following closure of the creosote manufacturing facility in 1969, the site was used intermittently as a storage facility for various refined and unrefined oils until 1978. Since 1977, the site has been used as a log sorting yard. All former creosote refining facilities have been removed, with the exception of a single-story office building.

2.3 Summary of Environmental Conditions

2.3.1 Site Characteristics

The subsurface geology is highly heterogeneous, and can be described as three zones: an *upper fill zone* of silty to medium-grained sand and imported material; an *intermediate silty peat zone* of soft to stiff dark brown to gray silty peat, organic woody silt, and silty fine-grained sand with interbedded gray and brown clay, silt, sand, and occasional ash lenses; and a *lower sand zone* of gray dense to medium dense, fine- to course-grained sand and gravel with cobbles and interbedded gray and brown silty fine-grained sand and silty lenses. Depth to bedrock at the site is unknown, but is generally believed to be greater than 150 ft along the current Lake Washington shoreline. Groundwater is found at depths of less than 10 ft below ground surface on the upland portion of the site, and discharges toward Lake Washington. Groundwater velocities are in the range of 0.05 ft/day in the silty peat zone and 0.5 ft/day in the lower sand unit. The lake bottom is generally less than 30 ft deep within the outer harbor line and is relatively flat.

2.3.2 Nature and Extent

This section summarizes the nature and extent of contamination at the site based on the results of the RI/FFS (Exponent 1999), and other studies and characterization activities performed at the site (Figures 2-4 through 2-14). A general discussion of the contaminants detected at the site is presented by media.

2.3.2.1 Soil

Elevated PAH concentrations have been detected in most of the upland soils (Figures 2-11a through 2-11c). Different types and concentrations of PAH compounds are present at the site. The soil contamination ranges from low-level concentrations of heavy-end coal tar residues to percent-level PAH contamination in other areas. There are localized areas affected with DNAPL, and other areas affected with light-end coal-tar distillates such as benzene, toluene, ethylbenzene, and xylenes (BTEX) compounds. Based on the results described in the RI/FFS (Exponent 1999), the constituents of concern (CoCs) in soil are PAH compounds, benzene, and DNAPL.

2.3.2.2 Groundwater

The site characterization data indicate that groundwater has been affected by PAH compounds, BTEX compounds, and DNAPL (Figures 2-9a through 2-9c). Areas of elevated levels of PAH and BTEX compounds correspond to those areas where DNAPL has been observed. Generally, groundwater is affected in those areas associated with former creosote refining facilities. Specifically, these areas include the Still House, North Sump, North Tank Farm, Quendall Pond, and former May Creek streambed. Much of the hydrocarbon product noted in exploratory boring logs is present below the water table, and the product appears to be confined to the upper soil horizons. Deep borings and wells located on the property have not shown evidence of DNAPL within the lower sand and gravel zone. The product appears to be contained within the interbedded silt, clay, sand, and peat layers present in the shallow soils. Based on the results described in the RI/FFS (Exponent 1999), the CoCs for groundwater are PAH compounds, benzene, and DNAPL.

2.3.2.3 Sediment

The available site characterization data indicate that sediments have been affected by PAH compounds, BTEX compounds, and wood waste. Elevated PAH concentrations in sediment have been measured in the areas near the end of the T-dock and in the nearshore areas offshore of Quendall Pond (the nearshore seep) (Figures 2-10a through 2-10c and Figure 2-14). Wood waste is present across the majority of the Quendall Terminals lake bottom, and consists of areas of greater than 50 percent wood waste, and areas of less than 50 percent wood waste. The areas of greater than 50 percent wood waste exist immediately offshore and extend south to the foot of the T-dock. Based on the results described in the RI/FFS (Exponent 1999), the CoCs for sediment are PAH compounds and wood waste.

2.3.3 Exposure Pathways

Potential pathways for chemical transport and exposure to human and/or ecological receptors may occur through soil, surface water, groundwater, and air. The pathways described in this section are based on the nature and extent of contamination presented in the RI/FFS (Exponent 1999). Exposure pathways associated with these environmental media and the potential for transport of CoCs at the site are discussed below.

2.3.3.1 Soil Pathway

The direct soil contact pathway can exist in areas where CoCs have affected surface soils and where there is unrestricted access to the affected soil areas. Currently, several areas of surface soil affected by CoCs are exposed and could present exposure potential for human populations; however, access to the site is limited and populations potentially exposed to site surface soils include only workers and visitors. The site is currently used as a log sorting yard, principally staffed by log sorting yard workers. Visitors at the site

include maintenance workers and field personnel conducting environmental investigations. No one currently resides onsite and children are not present.

2.3.3.2 Sediment Pathway

Contaminated sediments typically have two exposure pathways: direct contact and sediment to surface water. At the site, affected sediments are predominantly under several feet of water, and therefore site conditions eliminate the direct contact pathway.

Sediment to surface water transport is likely for site CoCs, given that site sediments have been affected by CoCs and are in constant contact with Lake Washington. Sediment impacts on surface water have been evaluated consistent with the Sediment Management Standards (SMS) (WAC 173-204).

2.3.3.3 Surface Water Pathway

The principal surface water exposure point at the site is Lake Washington. CoCs could potentially migrate into Lake Washington from affected groundwater, surface runoff, and DNAPL seeps through soil and sediment. No streams or perennial water bodies exist onsite, and no storm drains are present.

Potential human receptors affected by site surface water include recreational users and those who consume aquatic organisms from the lake. Lake Washington currently is not used as a drinking water source and is not likely to be used for drinking water in the future (WAC 173-201A, WAC 173-508). Potential ecological receptors evaluated include those species with habitat in the nearshore areas of the site.

2.3.3.4 Groundwater Pathway

The groundwater pathway involves the movement of chemicals into and through shallow groundwater at the site to potential downgradient receptors. To be considered a complete pathway, the CoCs must be incorporated into groundwater, either in a dissolved phase or carried along with the groundwater as a nonaqueous-phase liquid (NAPL), and ultimately be contacted by a human or ecological receptor.

Transport of CoCs to groundwater may occur through several mechanisms, including:

- Direct contact of contaminated soils with groundwater
- Direct contact of DNAPL with groundwater
- Leaching of contaminated soils in the vadose (unsaturated) zone and infiltration of contaminated leachate to groundwater.

Exposure scenarios for the groundwater exposure pathway consider any complete pathway. To determine which groundwater exposure pathways are complete, Hart Crowser (1997) recently researched the uses and potential uses of water in the area, and found that:

> The site facilities and all surrounding properties are served by municipal water lines of the City of Renton and will continue to be in the future. A search of well records and water right files was made to identify any possible water supply uses in the area, either from a groundwater source or Lake Washington. No water supply wells within a mile of the site were identified in the Water Well Records. Only three water right filings were found in a search of Ecology's Recorded Water rights database; they included:
>
> - A groundwater right for industrial use on the J.H. Baxter property to the north;
> - A Lake Washington surface water right to Henry Strauss for property across the lake on Mercer Island permitted for lawn and garden use only; and

- A Lake Washington surface water right to the Bellevue Sewer District for industrial sanitation use.

Lake Washington water is no longer available for consumptive appropriation as it was closed in 1979 to further withdrawals by Chapter 173-508 WAC. It is highly unlikely Lake Washington water will be used in the future because of this closure. Furthermore, any use of the surface water would require some form of treatment for bacterial purification prior to use for drinking purposes. These data indicate that although Lake Washington is classified as a Suitable Source of Water Supply under Chapter 173-201A WAC, it is not currently used as such, and is highly unlikely to be used as such in the future.

Based on this evaluation, the groundwater transport pathway is complete only for groundwater to surface water transport and potential ecological or recreational human receptors that could come into contact with groundwater discharging into Lake Washington.

2.3.3.5 Air Pathway

The air pathway involves the volatilization of chemicals from product (e.g., NAPL), soil, sediment, groundwater, or surface water and into site and offsite air. The most likely sources for CoCs in air from the site are product and affected soil and groundwater. To be considered a complete pathway, CoCs must volatilize and have a permeable or semipermeable pathway to site and/or offsite air. Site-specific conditions (e.g., the presence of lower permeability clay layers) and chemical-specific characteristics (e.g., the low volatility of PAHs) limit the potential concentrations of CoCs in air. Most of the CoCs that are found at the site have low volatility and thus will not generate significant concentrations in air. These include many of the constituents of DNAPL and PAH compounds.

Benzene, however, is a volatile compound. Onsite and offsite air was recently evaluated for benzene concentrations using soil vapor emission sampling and air dispersion modeling. Benzene was not detected during soil vapor emission testing (Hart Crowser

1997). Sampling and modeling indicate that benzene and other volatile compound concentrations in site soils and groundwater will not generate air concentrations above regulatory thresholds using even "worst-case" meteorological conditions. In addition, no benzene was detected in soil vapor samples in areas on the site that may serve as potential building areas. This eliminates the possibility of volatilized benzene accumulation to levels of concern in structures that may be built onsite (Hart Crowser 1997).

Based on this evaluation, the air pathway is not complete; therefore, no CoCs have been identified for this pathway.

3. Summary of Cleanup Standards

MTCA cleanup regulations state that a cleanup action must comply with cleanup levels for selected hazardous substances at identified points of compliance, and comply with state and federal applicable or relevant and appropriate requirements (ARARs) (WAC 173-340-710). The indicator hazardous substances identified for the site, associated cleanup levels, points of compliance, and ARARs are summarized in the following sections.

3.1 Indicator Hazardous Substances

Indicator hazardous substances were identified for the Quendall Terminals site using the criteria outlined in WAC 173-340-708(2). The indicator hazardous substances for soil and groundwater are PAH compounds and benzene. The indicator hazardous substances for sediments are PAH compounds and wood waste.

3.2 Media-Specific Cleanup Levels

3.2.1 Soil

The RI/FFS identified direct contact with soil as a concern for potential adverse human health effects. All soil with contaminant concentrations exceeding MTCA Method B direct contact criteria will require appropriate remedial measures. As part of the planned remediation and redevelopment of the site, the entire current site surface will be capped with clean soil, asphalt, or buildings, preventing direct contact with soil. In addition, institutional controls will be established to ensure that appropriate measures are taken to limit future exposure to affected soils. The RI/FFS also identified DNAPL as a CoC. As

part of the planned remediation, certain nearshore soils affected by DNAPL will be excavated.

3.2.2 Groundwater

Groundwater cleanup levels were developed using surface water standards that are protective of humans consuming aquatic organisms from Lake Washington. These surface water standards are the adopted ambient water quality criteria (WAC 173-201A and Section 304 of the federal Clean Water Act), the MTCA Method B risk-based formula values for surface water (WAC 173-340 sections 720 and 730), and the practical quantitation limits (PQLs) for those chemicals (WAC 173-340-700(6)) for which the possible cleanup levels are lower than the PQLs. The development of the groundwater cleanup levels is described in detail in the RI/FFS (Exponent 1999). The groundwater cleanup levels are as follows:

Constituent	Groundwater Cleanup Level	Basis
DNAPL	No Sheen	
Benzene	43	MTCA Method B formula values
Carcinogenic PAHs		
Benz[a]anthracene	0.1	PQL
Benzo[a]pyrene	0.1	PQL
Benzo[b]fluoranthene	0.1	PQL
Benzo[k]fluoranthene	0.1	PQL
Chrysene	0.1	PQL
Dibenz[a,h]anthracene	0.2	PQL
Indeno[1,2,3-cd]pyrene	0.1	PQL
Noncarcinogenic PAHs		
Acenaphthene	679	Ambient water quality criteria
Acenaphthylene	NA	–
Anthracene	25,900	MTCA Method B formula values
Benzo[ghi]perylene	0.1	PQL
Fluoranthene	90.2	MTCA Method B formula values
Fluorene	3,460	MTCA Method B formula values
2-Methylnaphthalene	NA	–
Naphthalene	9,880	MTCA Method B formula values
Phenanthrene	NA	–
Pyrene	2,590	MTCA Method B formula values

Note: All concentrations in µg/L
NA - not available

3.2.3 Sediments

Site-specific sediment cleanup levels were developed with Ecology and other resource agencies for PAH- and wood waste-affected sediments offshore of the Quendall Terminals site. Sediment quality standards under the SMS ensure that sediment quality that will result in no acute or chronic adverse effects on biological resources and human health (WAC 173-204-320). Ecology has used the apparent effects threshold (AET) approach to establish marine sediment quality values protective of biological resources.

To conform with state standards and the intent of the SMS, a sediment cleanup value for total PAH compounds was developed for Quendall Terminals site sediments following the AET approach. The site-specific cleanup level for sediment at the Quendall Terminals site is 100 mg/kg dry weight total PAH compounds. The development of sediment cleanup values is described in detail in the RI/FS (Exponent 1999).

Cleanup levels for wood waste cannot be developed using the SMS. However, Ecology may designate excessive wood waste as "other deleterious substances," and can require cleanup on a case-by-case basis (WAC 173-204-520(5)). At Ecology's discretion, the cleanup criterion for wood waste may be established based on specific site conditions.

For Quendall Terminals, the City and the resource agencies have agreed that sediments with wood waste concentrations greater than 50 percent (as defined by sediment vertical profile imaging and video transects) would be removed by dredging without further biological testing. However, areas with less than 50 percent wood waste may be capped based on toxicity testing that is currently scheduled for the summer of 2000 to assess whether wood waste in sediment is causing significant deleterious effects and whether the area to be capped can be reduced based on the test results.

3.3 Remedial Action Objectives

3.3.1 Soil

Based on site conditions and applicable standards for CoCs, the remedial action objectives (RAOs) for soil at the site are: 1) prevent direct human contact with soils affected by PAH compounds, and 2) reduce the mass of DNAPL in site soils.

3.3.2 Groundwater

The RAOs for groundwater at the site are: 1) prevent the migration of benzene and PAH compounds from groundwater to adjacent surface water at concentrations that would exceed applicable surface water quality standards, 2) reduce the mass of DNAPL in site groundwater, and 3) prevent use of groundwater as a drinking water source or for other direct uses.

3.3.3 Surface Water

The RAO for surface water at the site is to prevent the use of surface water as a drinking water source or for other direct uses.

3.3.4 Sediments

The RAOs for sediments are: 1) protect aquatic organisms from adverse biological effects that may occur from exposure to PAH compounds in sediments at concentrations in excess of applicable requirements for sediment quality, and 2) protect aquatic

organisms from adverse biological effects that may occur from exposure to wood waste in sediments.

3.4 Points of Compliance

3.4.1 Soil

Because the cleanup action at the site involves the containment of hazardous substances, the soil cleanup levels will not be met at the point of compliance. In these cases, Ecology may determine that the cleanup action complies with cleanup standards, provided that the compliance monitoring program is designed to ensure the long-term integrity of the containment system, and that the other requirements for containment technologies set forth in WAC 173-340-360(8) are met.

3.4.2 Groundwater

[Text to be provided.]

3.4.3 Sediments

In accordance with the SMS cleanup levels for sediments will be met upon completion of the cleanup action throughout the biologically active zone (generally interpreted to be the upper 10 cm).

3.5 Applicable Laws

The selected cleanup action will comply with federal, state, and local ARARs. Applicable requirements are promulgated federal and state laws or regulations that specifically apply to a hazardous substance, cleanup action, location, or a special circumstance at the site (e.g., presence of endangered species). Relevant and appropriate requirements are limited to those federal and state regulations that are not legally applicable, but address situations sufficiently similar that they may warrant application to the cleanup action. Potential ARARs pertinent to remediation alternatives include substantive requirements of Chapters 70.94, 70.95, 70.105, 75.20. 90.48, and 90.58 RCW. Others are identified and defined in the RI/FFS (Exponent 1999), including MTCA (WAC 173-340), Washington State SMS (WAC 173-204), Washington State Dangerous Waste Regulations (WAC 173-303), Washington State Water Quality Standards for Surface Water (WAC 173-201A), the substantive provisions of laws requiring or authorizing local government permits or approvals for the remedial action implementation, and Section 404 of the Clean Water Act, which requires approval to discharge dredged or filled materials into waters of the United States. Section 404 permits are regulated by the U.S. Army Corps of Engineers. A detailed list of the applicable laws is presented in the RI/FFS (Exponent 1999).

The State Environmental Policy Act (SEPA) is applicable to remedial actions at the Quendall Terminals site. Ecology is the lead agency for MTCA remedial actions performed under a Prospective Purchaser Consent Decree pursuant to WAC 197-11-253.

SEPA is triggered when a governmental action is taken on a public or private proposal. Under WAC 197-11-784, a proposal includes both regulatory decisions of agencies and actions proposed by applicants. Ecology has determined that a SEPA checklist is required.

If Ecology determines that the proposal may have a "probable significant adverse environmental impact," an environmental impact statement (EIS) is required that

examines potential environmental problems that would be caused by the proposal and options for mitigation. If in Ecology's opinion, there will be no significant adverse environmental impact, a Determination of Nonsignificance (DNS) is issued and the SEPA process is completed without preparation of an EIS. Under WAC 197-11-259, if Ecology makes a determination that the proposal will not have a probable significant adverse environmental impact, the DNS can be issued with the draft CAP prepared pursuant to MTCA.

The SEPA checklist and Ecology's SEPA determination are included as Appendix A. A public comment period is required for the SEPA determination. The SEPA public comment period will be combined with the comment period for this draft CAP to expedite and streamline public input.

4. Summary of Selected Cleanup Action

4.1 Site–Specific Cleanup Action Alternatives

In the final RI/FFS (Exponent 1999), site-specific cleanup action alternatives were developed and analyzed for soil, groundwater, and sediment to ensure protection of human health and the environment at the site. The following alternatives were screened in the RI/FFS:

- Soil Remediation Technologies
  - Excavation
  - Thermal desorption
  - Incineration
  - Bioremediation (landfarming)
  - Offsite landfill disposal
  - Soil washing
  - Stabilization/solidification
  - Capping
  - Soil flushing
  - *In situ* vitrification
  - Soil vapor extraction
  - Bioventing.

- Groundwater Remediation Technologies
  - Pump and treat and hydraulic control
  - *Ex situ* treatment
  - Natural attenuation
  - Impermeable barrier wall
  - Passive treatment wall
  - DNAPL recovery trenches
  - Biosparging.
- Sediment Remediation Technologies
  - Dredge and removal
  - Upland treatment
  - Nearshore containment facility
  - Natural recovery
  - Capping.

4.2 Selected Remedial Action

The following section presents the selected remedial actions for the Quendall Terminals property. These remedial actions were selected based on the results of the remedial technology alternative screening detailed in RI/FFS. The selected remedial actions are designed to protect human health and the environment, meet the RAOs for the site, and comply with the requirements of WAC 173-340-360.

The selected remedial actions were chosen based on a comparison of each cleanup alternative with the following MTCA remedy selection requirements (WAC 173-340-360(2) and (3)):

- Overall protection of human health and the environment
- Compliance with cleanup standards
- Use of permanent solutions to the maximum extent practicable
- Compliance with ARARs
- Provisions for compliance monitoring
- Provisions for a reasonable restoration time frame
- Consideration of public concerns following comment period.

The selected remedial actions for each medium at the site are described below and a summary of the selected alternatives and how they would address the RAOs is presented in Table 4-1.

4.2.1 Soil

The selected cleanup alternative for soil is nearshore excavation in defined areas and capping of the entire site.

DNAPL-affected soil in the vicinity of the shoreline will be excavated. The areas to be excavated include the former May Creek channel, the North Sump, and Quendall Pond, as shown on Figure 4-1. Excavation will begin at the Lake Washington shoreline and will move inland. A maximum of 25,000 yd^3 of DNAPL-affected soil will be treated and returned to the excavation. Overburden soil unaffected by DNAPL will be stockpiled

onsite during remedial activities and will be placed back in the excavation as part of the regrading process.

Capping will consist of placement of a 3-ft-thick cap of imported clean soil or pavement (or buildings) on the ground surface over the entire site to provide a physical barrier to CoCs in soil. Following construction of the planned development, the 3-ft-thick cap will be placed only in those areas that will be left uncovered after redevelopment (i.e., not covered by pavement or buildings). Provisions will be made to ensure proper surface water drainage at the site, maintain the integrity of the cap, and minimize contact of surface water drainage with soil contaminants. These provisions will be described in the engineering design report that will be completed as described in WAC 173-340-400(4)(a). The future site development features, such as buildings and parking lots, will serve as barriers to contact with soil contaminants at the site in place of the 3-ft soil cap. The extent of the area to be capped is shown on Figure 4-1. A schematic illustration of the soil cap is provided in Figure 4-2.

4.2.2 Groundwater

The selected groundwater remediation alternative consists of the installation of two DNAPL recovery trenches; the implementation of a groundwater monitoring program; and the implementation of institutional controls to prohibit the use of groundwater. Groundwater extraction and treatment has been found to be infeasible at the Quendall Terminals site. Therefore, biosparging has been selected as a contingent remedy. Institutional controls are described in Section 6—*Institutional Controls and Site Use Restrictions.*

DNAPL recovery trenches extending to a depth of approximately 20–25 ft below ground surface will be placed across the North Sump and former May Creek DNAPL plumes. The trenches will be located on the upgradient side of the excavated areas near the former

May Creek channel and the North Sump to prevent the migration of DNAPL into the excavated areas.

DNAPL recovered in the trenches will be removed using a recovery sump or by hand bailing. The recovered DNAPL will be periodically transported to a treatment/recycling facility. Soils excavated during the trenching activities will be managed like other excavated onsite soils. The DNAPL recovery trenches will be designed so that the volume of water generated during recovery operations will be minimized to the extent practicable. The engineering design report and the operation and maintenance plans will describe the monitoring and maintenance of these systems. During implementation of the remedial alternative, operation of a recovery trench can be discontinued when no further DNAPL (beyond a sheen) enters the trench.

The groundwater monitoring well network will consist of two types of monitoring wells—sentinel wells and point of compliance wells. The location and purpose of each type of well is described below.

The sentinel wells will be installed downgradient of the locations of the buildings to be constructed onsite and will be screened at the maximum depth of the driven steel geotechnical pilings. As described in Section 3.9 of the RI/FFS (Exponent 1999), Ecology has approved the installation of driven steel geotechnical pilings at the site. The sentinel wells will be used to monitor the impacts of the driven steel pilings and provide information for initiation and cessation of contingent remedy operation in the upgradient areas. There will be a maximum of six sentinel wells installed.

[Additional text to be provided.]

4.2.3 Sediments

The selected remedial alternative for sediments varies among the affected areas. T-dock sediments that have been identified as containing greater than 100 mg/kg PAH will be dredged, dewatered, and treated either onsite or offsite via thermal desorption. The volume of sediment to be removed and treated from the T-dock area will not exceed 12,400 yd^3, assuming a maximum sediment removal depth of 3 ft. The T-dock dredge area will be backfilled with treated sediments and restored to its original grade. The areas to be excavated are shown on Figure 4-1.

The nearshore seep DNAPL area will be excavated to a maximum depth of 6 ft. The portions of the nearshore seep areas that do not exhibit a DNAPL seep will be excavated to a maximum depth of 3 ft. The total volume of soil to be excavated from the nearshore seep area will not exceed 21,480 yd^3. Soil excavated from the nearshore areas will be dredged, dewatered, and treated either onsite or offsite via thermal desorption. The nearshore seep area will be backfilled with low permeability soil and restored to its original grade.

Sediments with more than 50 percent wood waste will be dredged and recycled, if practicable, or disposed of in an offsite landfill. Because the removal of this wood waste sediment will restore the lake bottom to its approximate original contours, backfilling with imported materials in these areas will not be necessary. The volume of the wood waste/sediment to be removed will not exceed 48,000 yd^3.

The "gray zone" sediments—sediments that contain less than 50 percent wood waste and have a redox potential discontinuity of less than 0.8 cm—may be covered with a cap consisting of imported clean fill and/or treated sediments and soils to a maximum depth of 1 ft. The U.S. Environmental Protection Agency has determined that a 1-ft cap of granular material provides sufficient separation between the affected sediments and aquatic organisms (U.S. EPA 1998). The maximum cap volume is 52,200 yd^3. Additional testing to further characterized the gray zone is currently scheduled for

summer 2000. If further characterization demonstrates that the gray zone is not adversely affecting benthic habitat, then the area to be covered with the 1-ft cap may be reduced.

4.2.4 Contingent Remedies

A contingency remedy is a cleanup technology that serves as a backup remediation technology in the event that the primary remedy does not achieve the cleanup levels at the points of compliance within a given time frame. Contingent remedies are initiated based on exceedances of the trigger levels, as described in Section 3.7.2 of the RI/FFS (Exponent 1999).

4.2.4.1 Contingent Remedy for Trigger Level Exceedance at the Points of Compliance

[Additional text to be provided.]

4.2.4.2 Operational Contingent Remedy for Water Quality Exceedance in the Piling Sentinel Wells

In addition to the contingent remedies described for the points of compliance, there is a specific operational criterion for the upgradient biosparging system that will determine when operation of the biosparging system is initiated or discontinued in certain areas. The contingent remedy will be activated as described in the Sentinel Well Contingent Remedy portion of the flowchart on Figure 4-3 **[to be provided]**. The sentinel wells are intended to monitor groundwater quality in the areas where geotechnical piles will be installed.

If groundwater from the upgradient groundwater monitoring wells have concentrations of greater than 15 times the groundwater cleanup level, the contingent remedy will be

initiated. This criterion was selected based on the estimated travel time of groundwater in the lower portion of the aquifer, and the expected anaerobic degradation rate of benzene. The estimated travel time was calculated using a hydraulic conductivity of 57 ft/day, a hydraulic gradient of 0.002, and a porosity of 0.25 (Hart Crowser 1997). This yields a groundwater flow velocity of 0.456 ft/day (assuming no chemical retardation). The approximate minimum distance between the sentinel wells and the point of compliance wells is 200 ft, yielding an estimated travel time of approximately 438 days. Assuming a first-order anaerobic degradation rate for benzene of 0.0062 (Howard et al. 1991), the degradation factor is calculated to be 15.11. Based on this degradation factor, a level of 15 times groundwater cleanup levels is an appropriate performance criterion.

Within 120 days of pile installation in a particular area, a sentinel well will be either installed or activated. Groundwater from the sentinel wells will be sampled quarterly. If samples from the wells do not exceed 15 times the groundwater criteria for four consecutive quarters, then annual monitoring will be initiated. If no exceedances occur during two years of annual groundwater monitoring, then groundwater monitoring will be discontinued at that location. If exceedances of 15 times the groundwater criteria are detected, biosparging will be initiated in that area. If four consecutive quarters occur without groundwater exceedances, biosparging will be discontinued in that area and the sentinel well will re-enter the standard sentinel well monitoring program.

4.2.4.3 Contingent Remedy for the Appearance of Visible NAPL Seeps in Lake Washington

For the selected remedial alternative, excavation and offsite disposal will be the contingent remedy for the appearance of a visible NAPL seep in Lake Washington.

If a new NAPL seep is discovered, surface sediment will be excavated to a maximum depth of 4 ft, clean sediment will be placed in the excavation, and the area will be

brought back to its original grade by placing clean sediment on the surface. If this contingent remedy is necessary, visual inspection of the area will be included in the performance and confirmational monitoring program implemented at the site.

4.2.4.4 Contingent Remedy for the Appearance of Visible NAPL Seeps in Upland Areas

For the selected remedial alternative, the contingent remedy for the appearance of a visible NAPL seep in an upland area will be the excavation of the immediate area, and the application of new cap material. If an upland NAPL seep is discovered, the area will be cordoned off from public access. The surface soils will be excavated to a depth of 3 ft in the immediate vicinity of the seep. The extent of the excavation will depend on the appearance of NAPL in the 3-ft deep excavation. These surface soils will be disposed of offsite. Clean fill will be placed in the excavation to bring the surface back to its original grade. If this contingent remedy is necessary, monitoring of the upland seep will be included in the performance and confirmational monitoring program for the site.

4.2.5 Types, Levels, and Amounts of Remaining Hazardous Substances

For containment actions, the type, levels, and amounts of hazardous substances remaining onsite must be specified (WAC 173-340-360 (10)(a)(ix)). The selected alternative will leave hazardous substances onsite, including NAPL, as well as soil affected by PAH and NAPL, and groundwater affected by PAH, benzene, and NAPL.

The volume of affected soil to be left in place was estimated based on available characterization data. The level of impact is defined as all soil exhibiting NAPL, total PAH compound concentrations greater than 1,000 mg/kg, and total carcinogenic PAH compound concentrations greater than 1.0 mg/kg. The volume of soil exhibiting NAPL is estimated to be 49,180 yd^3. The volume of soil exhibiting total PAH compound

concentrations greater than 1,000 mg/kg is estimated at 147,180 yd^3, and the volume of soil exhibiting total carcinogenic PAH compound concentrations greater than 1.0 mg/kg is estimated at 426,470 yd^3 (RETEC 1997). As described in Section 4.2.1, a maximum of 25,000 yd^3 will be excavated and treated.

4.2.6 Compliance Monitoring

Compliance monitoring will be performed as required by WAC 173-340-410. The purposes of compliance monitoring and data evaluation are:

- **Protection Monitoring**—To confirm that human health and the environment are adequately protected during construction and during the operation and maintenance period, as described in the health and safety plan.
- **Performance Monitoring**—To confirm that the cleanup action has attained cleanup performance standards.
- **Confirmational Monitoring**—To confirm the long-term effectiveness of the cleanup action once the cleanup or performance standards have been met.

This section describes the compliance monitoring that will be performed at the site. Prior to implementation of the remedial actions, detailed sampling and analysis plans, and data analysis and evaluation procedures will be submitted to Ecology in compliance with WAC 173-340-410(3)(a) and (b).

4.2.6.1 Protection Monitoring

The objective of protection monitoring is to confirm that human health and the environment are adequately protected during all phases of the cleanup action (WAC 173-340-410(1)(a)). Protection monitoring will be addressed in the health and safety plan prepared in conjunction with the engineering design report, construction plans and specifications, and the operation and maintenance plan (WAC 173-340-400).

4.2.6.2 Performance Monitoring

The objective of performance monitoring is to confirm that the cleanup action has attained performance and cleanup standards (WAC 173-340-410(b)). Performance monitoring will consist of groundwater sampling and inspections of the caps and other onsite containment systems. Performance monitoring is detailed below, and will be performed until criteria have been met as described in on Figure 4-3 **[to be provided]**.

Performance Criteria—The site-specific performance criteria for the cleanup actions are:

- **Soil**—The selected cleanup alternative for site soils is placement of a 3-ft thick cap of imported clean soil, or paved parking lots or buildings over the entire ground surface. The performance criteria for this portion of the cleanup action is the physical integrity of the soil cap, parking areas, and buildings.
- **Groundwater**—The selected cleanup alternative for site groundwater is institutional controls restricting the use of groundwater, installation of a biosparging system, and installation of DNAPL recovery trenches. The general performance criteria for the groundwater system is a reduction in the quantity of NAPL in site monitoring wells, and a reduction in the dissolved concentrations of benzene and PAH-

indicator compounds in site monitoring wells. The physical removal of DNAPL and DNAPL-affected soil will also reduce the ongoing source of contamination to groundwater.

- **Sediments**—The selected cleanup alternative for site sediments includes: 1) excavation of the T-dock and Quendall Pond sediments that have been identified as containing greater than 100 mg/kg dry weight total PAH compounds, 2) excavation of areas identified as containing greater than 50 percent wood waste, 3) placement of a 1-ft cap over the rest of the gray zone, if required, and 4) excavation and removal to 6 ft below the mudline in the Quendall Pond nearshore areas. The performance criteria for this portion of the cleanup action is the physical integrity of the 1-ft cap, if required.

Monitoring and Schedule—The performance criteria monitoring will take place using the following criteria and schedule:

- **Soil**—Performance monitoring of the soil cap will consist of visually inspecting the soil cap to verify that it is intact. This monitoring will occur annually.

- **Groundwater**—Groundwater performance monitoring will consist of checking groundwater monitoring wells for the presence of NAPL, as well as sampling the onsite groundwater monitoring wells and analyzing the samples for benzene and PAH-indicator compounds. The groundwater monitoring network will involve both sentinel and point of compliance wells.

  The sentinel wells will be used to monitor whether the installation of the driven, steel geotechnical pilings will affect groundwater quality in

the lower part of the aquifer, and to trigger contingent remedies, if required.

The point of compliance wells will be used to measure the reduction of benzene and PAH-indicator compound concentrations in groundwater, to measure achievement of the performance criteria at the point of compliance, and to trigger contingent remedies, if required.

The point of compliance wells will measure changes in the presence of NAPL and the concentrations of benzene and PAH-indicator compounds, and document compliance with cleanup standards at the site.

Groundwater monitoring in all onsite monitoring wells will occur as described in Figure 4-3 **[to be provided]**. The wells to be monitored are the sentinel wells and the point of compliance wells.

- **Sediments**—Performance monitoring of the sediment cap will consist of visually inspecting the sediment cap to verify that it is intact. This monitoring will occur once every 2 years.

4.2.6.3 Confirmational Monitoring

The objective of confirmational monitoring is to confirm the long-term effectiveness of the cleanup action once performance and cleanup standards have been met (WAC 173-340-410(1)(c). Confirmational monitoring will involve groundwater monitoring and visual inspections of the caps and other containment structures.

Confirmational monitoring is described on Figure 4-3 **[to be provided]**.

Compliance Criteria—The compliance criteria for confirmational monitoring at the site will be the physical integrity of the containment systems and compliance with groundwater cleanup standards described above and in the RI/FFS (Exponent 1999). The groundwater cleanup standards are applicable at the points of compliance.

Sampling, Analysis, and Schedule—The content and schedule for confirmational monitoring are as follows:

- **Soil**—Confirmational monitoring of the soil cap will consist of visually inspecting the soil cap every 5 years to verify that it is intact. This monitoring will be stipulated in the restrictive covenant that will be placed on the property.
- **Groundwater**—Confirmational monitoring of groundwater will consist of sampling the groundwater confirmational monitoring network (i.e., point of compliance monitoring wells) and analyzing the samples for benzene and PAH compounds. Groundwater samples will be filtered in accordance with WAC 173-340-720(8)(a). Confirmational groundwater monitoring will be performed as described on Figure 4-3 **[to be provided]**.
- **Sediments**—Confirmational monitoring of the sediment cap will consist of visually inspecting the sediment cap to verify that it is intact. This monitoring will occur once every 5 years.

4.2.7 Periodic Review

The selected cleanup action will leave hazardous substances in place that exceed MTCA Method B cleanup levels. Therefore, under WAC 173-340-420, periodic review will be required. This review will take place every 5 years after initiation of the cleanup action.

5. Selection of Preferred Alternative

This section discusses the selection of the preferred alternative and the implementation schedule for that alternative. The selected remedial actions protect human health and the environment, meet the RAOs for the site, and comply with the requirements of WAC 173-340-360. The selected remedial actions were chosen based on a comparison of each alternative with the following MTCA remedy selection requirements (WAC 173-340-360(2) and (3)). The requirements are to:

- Protect human health and the environment
- Comply with cleanup standards (WAC 173-340-700)
- Comply with applicable state and federal laws (WAC 173-340-710)
- Provide for compliance monitoring (WAC 173-340-410).
- Use permanent solutions to the maximum extent practicable (WAC 173-340-360(2), (3), (4), (5), (7), and (8)
- Provide a reasonable restoration time (WAC 173-340-360(6))
- Consider public concerns (WAC 173-340-600).

Detailed descriptions of the remedial actions selected for each medium at the site are presented in the previous chapter and are briefly summarized below.

The selected cleanup alternatives for site soils are excavation of DNAPL-affected soil and placement of a 3-ft cap of imported clean soil, pavement, or buildings on the ground surface over the entire site to provide a physical barrier to CoCs in soil. The areas to be excavated include the former May Creek channel, the north sump, and Quendall Pond. Following construction of the planned development, a 3-ft-thick cap will be placed only in those areas that will be left uncovered after redevelopment (i.e., not covered by

pavement or buildings). Institutional controls will be established that will provide for ongoing maintenance of the cap over affected soils.

The selected groundwater remediation alternative consists of two DNAPL recovery trenches and institutional controls to prohibit the use of groundwater. Biosparging has been selected as a contingent remedy. Institutional controls are described in Section 6, *Institutional Controls and Site Use Restrictions*.

The DNAPL recovery trenches extending to a depth of approximately 20–25 ft below ground surface will be placed across the north sump and former May Creek DNAPL plumes. The DNAPL recovery trenches will allow the removal of subsurface DNAPL remaining in the upland areas.

As a contingent remedy to address contaminated groundwater, biosparging wells will be installed in and around the three excavations and in the upgradient areas near the geotechnical piles.

The groundwater monitoring well network will consist of two types of monitoring wells: sentinel wells, and point of compliance wells. The sentinel wells will be installed downgradient of the locations of the buildings to be constructed onsite and will be screened at the maximum depth of the driven steel geotechnical pilings. The point of compliance wells will be used to measure and document compliance with groundwater cleanup standards.

The selected remedial alternative for sediments varies among the affected areas. T-dock sediments that have been identified as containing greater than 100 mg/kg total PAH compounds will be dredged, dewatered, and treated either onsite or offsite via thermal desorption.

The nearshore seep DNAPL area will be excavated to a maximum depth of 6 ft. The portions of the nearshore seep areas that do not exhibit a DNAPL seep will be excavated

to a maximum depth of 3 ft. The nearshore seep area will be backfilled with low permeability soil and restored to its original grade.

Sediments with more than 50 percent wood waste will be dredged and recycled, if practicable, or disposed of in an offsite landfill.

The "gray zone" sediments (sediments that contain less than 50 percent wood waste and have a redox potential discontinuity of less than 0.8 cm) may be covered with a maximum of 1 ft cap consisting of imported clean fill and/or treated sediments and soils. Additional testing to further characterize the gray zone is currently scheduled for summer 2000. If this characterization demonstrates that the gray zone is not adversely affecting benthic habitat, then the area to be covered with the 1-ft cap may be reduced.

The following is a description of how the selected remedial actions meet the threshold requirements and other requirements described in MTCA.

5.1 Overall Protection of Human Health and the Environment

The proposed cleanup action provides significant improvement in the protection of human health and the environment over current conditions and will meet the RAOs established for the Quendall Terminals site. The cleanup action provides mechanisms for treatment or collection and removal of site contaminants and will be protective of human health and the environment by eliminating potential exposure to site contaminants and by limiting further offsite contaminant migration

Construction of the soil cap over upland surface soils and implementation of appropriate institutional controls will prevent direct human contact with residual soil contaminants at the site. Excavation of DNAPL-affected soil will limit migration of contaminants with groundwater to Lake Washington and will minimize potential exposure of human and ecological receptors to groundwater contaminants. Removal and treatment or recycling

of PAH-contaminated sediments and wood waste will result in a permanent reduction in contaminant volume in the lake sediments. These activities, in addition to the capping of gray zone sediments, if necessary, will improve lake habitat and reduce the potential for human and ecological exposure to sediment contaminants. Removal of affected sediment in the dredged area of the nearshore seep will limit the potential for migration of subsurface DNAPL to the lake and lake sediments.

5.2 Compliance with Cleanup Standards

The proposed cleanup action is designed to comply with cleanup standards and all applicable laws and regulations. Compliance monitoring will be performed to assess whether cleanup levels and RAOs are being met, ensure the performance of remedial systems, and determine when DNAPL recovery, groundwater biosparging (if activated) and groundwater monitoring are no longer required. The selected alternative meets all state and federal laws and all activities used to implement the remedy will meet the substantive requirements of any laws requiring local governments permits or approvals.

While all the selected sediment and groundwater remedial actions are permanent solutions, some of the selected soil cleanup actions are not, as defined in WAC 173-340-360-5(c). However, the results of the screening evaluation showed that the selected soil remedy would successfully comply with RAOs and the other requirements. Furthermore, none of the potentially applicable technologies for *in situ* treatment of soils at the Quendall Terminals site would meet the site RAOs. Excavation and treatment/reuse of all site soils affected by DNAPL was determined to be technically impracticable because of the extent of contamination at the site, and the prohibitively high cost when compared to protective containment solutions. The incremental cost of *ex situ* treatment of all DNAPL-affected site soil is disproportionate to the incremental degree of protection achieved relative to capping, and the selected groundwater remedial alternative will address the ongoing groundwater contamination issues. Thus, the partial excavation of DNAPL-affected soils is an appropriate remedial action. The excavation will commence

at the Lake Washington shoreline and move inland. This concentrated effort to reduce the effects to the surface water pathway is an appropriate action, and will reduce the ongoing impacts of affected soil to groundwater.

5.3 Compliance with ARARs

The selected cleanup action will comply with federal, state, and local ARARs. Applicable requirements are promulgated federal and state laws or regulations that specifically apply to a hazardous substance, cleanup action, location, or a special circumstance at the site (e.g., presence of endangered species). Relevant and appropriate requirements are limited to those federal and state regulations that are not legally applicable, but address situations sufficiently similar that they may warrant application to the cleanup action. Potential ARARs pertinent to remediation alternatives include substantive requirements of Chapters 70.94, 70.95, 70.105, 75.20, 90.48, and 90.58 RCW. Others are identified and defined in the RI/FFS (Exponent 1999), including MTCA (WAC 173-340), Washington State SMS (WAC 173-204), Washington State Dangerous Waste Regulations (WAC 173-303), Washington State Water Quality Standards for Surface Water (WAC 173-201A), the substantive provisions of laws requiring or authorizing local government permits or approvals for the remedial action implementation, and Section 404 of the Clean Water Act, which requires approval to discharge dredged or filled materials into waters of the United States. Section 404 permits are regulated by the U.S. Army Corps of Engineers. A detailed list of the applicable laws is presented in the RI/FFS (Exponent 1999).

The SEPA is applicable to remedial actions at the Quendall Terminals site. Ecology is the lead agency for MTCA remedial actions performed under a Prospective Purchaser Consent Decree pursuant to WAC 197-11-253.

SEPA is triggered when a governmental action is taken on a public or private proposal. Under WAC 197-11-784, a proposal includes both regulatory decisions of agencies and

actions proposed by applicants. Ecology has determined that a SEPA checklist is required.

If Ecology determines that the proposal may have a "probable significant adverse environmental impact," an EIS is required that examines potential environmental problems that would be caused by the proposal and options for mitigation. If in Ecology's opinion, there will be no significant adverse environmental impact, a DNS is issued and the SEPA process is completed without preparation of an EIS. Under WAC 197-11-259, if Ecology makes a determination that the proposal will not have a probable significant adverse environmental impact, the DNS can be issued with the draft CAP prepared pursuant to MTCA.

The SEPA checklist and Ecology's SEPA determination are included as Appendix A. A public comment period is required for the SEPA determination. The SEPA public comment period will be combined with the comment period for this draft CAP to expedite and streamline public input.

5.4 Provision for Compliance Monitoring

The selected alternative provides for long-term monitoring to ensure that soil, groundwater, and sediment continue to meet cleanup standards after remedial actions have been completed (WAC 173-340-410). Protection monitoring will be used to ensure that human health and the environment are protected during construction of the remedial systems, as will be described in the site health and safety plan. During remedial actions, performance monitoring will be conducted to confirm that cleanup actions have attained cleanup standards and treatment goals. After remedial actions have been completed, confirmational monitoring will be conducted to confirm and ensure that cleanup actions have attained cleanup standards and performance standards.

5.5 Use of Permanent Solutions

WAC 173-340-360(5) specifies that the cleanup action use permanent solutions to the maximum extent practicable. The general provisions under this requirement include the following:

- The cleanup action uses permanent solutions wherever practicable
- The cleanup action maximizes the use of preferred treatment technologies, as specified in WAC 173-340-360(4) (i.e., preferred technologies favor reuse/recycling and destruction/detoxification)
- The cleanup action achieves cleanup standards without further action
- The cleanup action prevents or minimizes offsite migration of contaminants and provides for a net reduction in source materials
- The cleanup action does not rely solely on dilution, institutional controls, and/or monitoring.

WAC 173-340-360(5)(d) specifies that if a permanent solution is not practicable, the cleanup action shall be evaluated based on: a) the degree of overall protection of human health and environment; b) long- and short-term effectiveness; c) the degree of permanent reduction in toxicity, mobility, and volume of contaminants; d) implementability; e) cleanup cost; and f) community acceptance.

The selected remedial alternative uses technologies with a higher preference, according to MTCA (WAC 173-340-360(4)(a)), for the more heavily impacted areas of the site and for the most critical exposure pathways. In addition, the selected remedial alternative minimizes the dependence on institutional controls and engineering controls to ensure that the remedy is effective.

To the extent practicable, the proposed remedial actions provide a permanent solution, and in those cases where the permanent solution was not practicable, the remedies have been selected that provide the greatest compliance with items a through f shown above.

The excavation and treatment of DNAPL-affected soils is a permanent solution since the DNAPL will be permanently removed from these soils, and the cleanup action uses a preferred treatment technology, prevents offsite migration, provides a net reduction in source materials, and does not rely solely on dilution, institutional controls, or monitoring.

The removal of all onsite DNAPL-affected soils is not feasible from a cost perspective. DNAPL-affected soils exist a significant distance upland of the Lake Washington shoreline. The impact of these DNAPL-affected soils on Lake Washington water quality will be monitored and mitigated through the proposed remedial action. The monitoring will consist of the compliance monitoring in the mudline wells. The DNAPL recovery trenches and the contingent remedy (biosparging) will mitigate the impacts of these remaining DNAPL-affected soils.

The capping of the site with either a 3-ft soil cap or with redevelopment features is not a permanent solution for PAH-affected soils. However, capping does provide a high degree of overall protectiveness, is effective in both the short- and long-term, is implementable, and has acceptable cleanup costs.

The removal of site DNAPL and the implementation of biosparging (if required) are permanent solutions to groundwater issues at the site. The selected remedial alternative uses preferred treatment technologies, as DNAPL removal and biosparging are destruction/ detoxification technologies; minimizes the offsite migration of contaminants; and provides for a net reduction of the source material.

The removal of T-dock and nearshore seep sediments, and wood waste greater than 50 percent will provide a permanent solution. The proposed cleanup action maximizes

the use of preferred technologies. Because it is a removal action, the proposed cleanup achieves cleanup standards without further action, and the cleanup action does not rely solely on institutional controls or monitoring. The removal of affected sediments provides compliance with cleanup standards with no further action or controls.

5.5.1 Long-Term Effectiveness

The proposed remediation activities provide a high degree of long-term reliability (i.e., from the completion of remedial objectives until compliance and monitoring has been completed). The integrity and long-term performance of the soil cap will be ensured by the development of proper site drainage, vegetation of the cap, and the placement of buildings during site redevelopment, as well as by the establishment of appropriate institutional controls. The removal and treatment of DNAPL-affected soil provides permanent removal of DNAPL. Long-term operation of the DNAPL recovery trenches and biosparging system (if required) will ensure the long-term performance of the system. Operation and maintenance of these systems is simple and does not require highly specialized training, and financial assurance for their continued operation will be provided (as specified by WAC 173-340-440). Sediment contaminants and wood waste will be removed and treated and/or recycled, leading to a permanent reduction in sediment contaminants.

5.5.2 Short-Term Effectiveness

Properly trained personnel will conduct all remediation efforts, and all appropriate safety precautions will be taken. The remediation contractor will have and will follow a health and safety plan. Health and safety monitoring will be conducted during remediation, and personnel will use personal protective equipment appropriate for the level of safety required at the site. Excavation and dredging activities will lead to potential contact of workers with contaminants, as will operation and maintenance of the DNAPL recovery

system; appropriate precautionary measures will be taken during the performance of these activities. Offsite transport of recovered DNAPL will be managed in appropriate transport trucks and in accordance with applicable Department of Transportation regulations. The cleanup action will be performed over a limited time frame, thereby limiting potential exposure time.

5.5.3 Reduction of Toxicity, Mobility, or Volume Through Treatment

The reduction of toxicity, mobility, or volume through treatment criteria is a reflection of Ecology's expectation under WAC 173-340-360(5)(d)(i)(v) to implement remedial actions that employ treatment technologies that permanently and significantly reduce the toxicity, mobility, and volume of the hazardous substances. The proposed remedial actions provides a high degree of reduction of toxicity, mobility, and volume of the CoCs at the site. The proposed soil actions reduce the mobility and volume of the CoCs by physically removing the DNAPL affected soils and by capping the remainder of the site. The groundwater remedial actions reduce the volume of DNAPL and DNAPL affected groundwater through both the DNAPL recovery trenches and the contingent biosparging system. The sediment remedial actions reduce the volume of wood waste and PAH affected sediments by removing and/or treating these sediments.

5.5.4 Implementability

The implementability criterion includes an evaluation of the technical and administrative feasibility of implementing the alternative and the availability of various services and materials required for implementation.

The proposed remedial alternative uses demonstrated, readily available technologies that can be installed using conventional construction and marine equipment. None of the remedial measures involves use of complex equipment or requires complex operation and

maintenance. The proposed construction schedule will allow sufficient time to identify and obtain the necessary construction permits, and to identify and establish specific institutional controls.

5.5.5 Cost and Effectiveness

A cost estimate was prepared of the selected remedial alternative. This estimate includes the capital cost portion of the cleanup. The cost estimate and the assumed unit costs are included in Appendix B. The total estimate cleanup cost is $17.3 million.

5.6 Reasonable Restoration Timeframe

The selected remedial approach includes substantial source excavation and treatment followed by capping of residual affected soil. Source removal and treatment will be performed using standard earth moving equipment and techniques. Excavation and treatment of these source areas, both upland and in-water, can be completed in less than two years. The complete capping of affected soil is dependent on the site development schedule since landscaping, parking lots, and building foundations all comprise portions of the cap. This work is anticipated to begin during site remediation activities, but the schedule for redevelopment activities has not been determined.

5.7 Consideration of Public Concerns

Public input will be solicited through the public involvement process. This process includes the opportunity for the public to read and formally comment on the RI/FFS and CAP documents. Assessment of the community acceptance criterion for the alternative will be completed following input from the public.

5.8 Summary

The remediation technologies discussed in this CAP were selected partially on the basis of their ability to meet the desired rapid site remediation and redevelopment time frame. The start date for implementation of the cleanup action is currently expected to occur in summer 2000, and it is anticipated that the implementation of the remedial actions will be completed by the fall of 2002. This schedule will permit the redevelopment and re-use of an important part of the City's waterfront.

Properly trained personnel will conduct all remediation efforts, and all appropriate safety precautions will be taken. The remediation contractor will have and follow a health and safety plan. Health and safety monitoring will be conducted during remediation, and personnel will use personal protective equipment appropriate for the level of safety required at the site.

The proposed remedial actions use demonstrated, readily available technologies that can be installed using conventional construction and marine equipment. None of the remedial measures involves use of complex equipment or requires complex operation and maintenance. The proposed construction schedule will allow sufficient time to identify and obtain the necessary construction permits, and to identify and establish specific institutional controls.

The total estimated cleanup cost is $17,300,000. A detailed breakdown of this estimate is provided in Appendix B.

6. Institutional Controls and Site Use Restrictions

Institutional controls will be implemented, and will include appropriate measures designed to protect the integrity of the cleanup action and remedial components, and prevent exposure to residual contaminants at the site. Elements of the restrictive covenants for the site include: 1) prohibition of the use or beneficial withdrawal of site groundwater, 2) no placement of wells other than those required under this CAP, 3) prohibition of ground floor residential use, 4) prohibition against swimming or other activities that will lead to direct contact with aquatic sediments, and 5) cap or cover maintenance requirements. The text of the restrictive covenants is attached as Appendix C.

7. Implementation Schedule

7.1 Finalization of Remedial Design Elements

Documents prepared in compliance with WAC 173-340-400(4) that will include designs, construction plans, and operational descriptions of the cleanup action will be submitted to Ecology prior to and during the cleanup actions at the site. These submittals include:

- An engineering design report that describes the engineering concepts and design criteria used for the design of the cleanup action. This engineering design report will include a health and safety plan and will address the requirements of WAC 173-340- 400(4)(a).
- Construction plans and specifications, as required in WAC 173-340-400(4)(b).
- An operation and maintenance plan, as required in WAC 173-340-400(4)(c).
- Construction documentation, including appropriate as-built drawings, as required in WAC 173-340-400(7)(b)(ii).

7.2 Schedule

The documents shown above will be prepared during winter 1999/2000 and spring 2000. It is anticipated that remediation construction will commence in the summer of 2000, and that remediation will be completed by October 1, 2002.

8. Declarative Statement

Consistent with Chapter 70.105D RCW, "Model Toxics Control Act," as implemented by Chapter 173-340 WAC, "Model Toxics Control Act Cleanup Regulation," it is determined that the selected cleanup actions are protective of human health and the environment, attain federal and state requirements which are applicable or relevant and appropriate, comply with cleanup standards, and provide for compliance monitoring. The cleanup actions satisfy the preference expressed in WAC 173-340-360 for the use of permanent solutions to the maximum extent practicable, provide for a reasonable restoration time frame, and consider public concerns raised during public comment on the draft CAP.

Brian Sato — Date
Site Manager
Toxics Cleanup Program, NWRO
Washington State Department of Ecology

Steve Alexander — Date
Acting Section Manager
Toxics Cleanup Program, NWRO
Washington State Department of Ecology

9. References

Exponent. 1999. Remedial investigation and focused feasibility study for the Quendall Terminals property. Prepared for City of Renton, Renton, Washington. Exponent, Bellevue, WA.

Hart Crowser. 1997. Final remedial investigation, Quendall Terminals Uplands, Renton, Washington, Volume I.

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RETEC. 1998. Unpublished data and figures compiled in 1998 by RETEC. RETEC, Seattle, WA.

RETEC. 1999. Unpublished data and figures compiled in 1999 by RETEC. RETEC, Seattle, WA.

U.S. EPA. 1998. Assessment and remediation of contaminated sediments (ARCS) program, guidance for in-situ subaqueous capping of contaminated sediments EPA/905/B-96/004. U.S. Environmental Protection Agency, Great Lakes National Program Office, Chicago, IL.

Figures

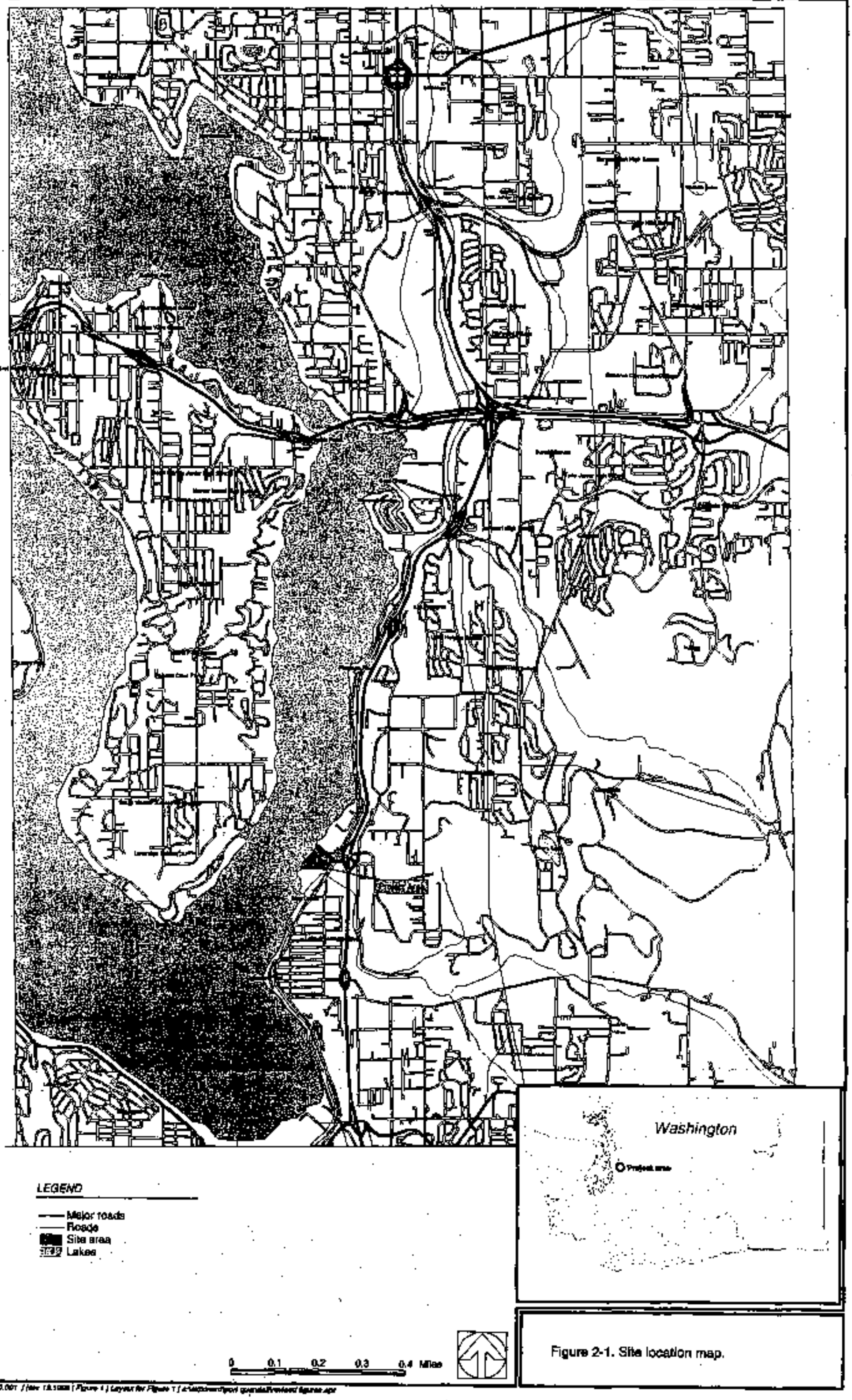


Figure 2-1. Site location map.

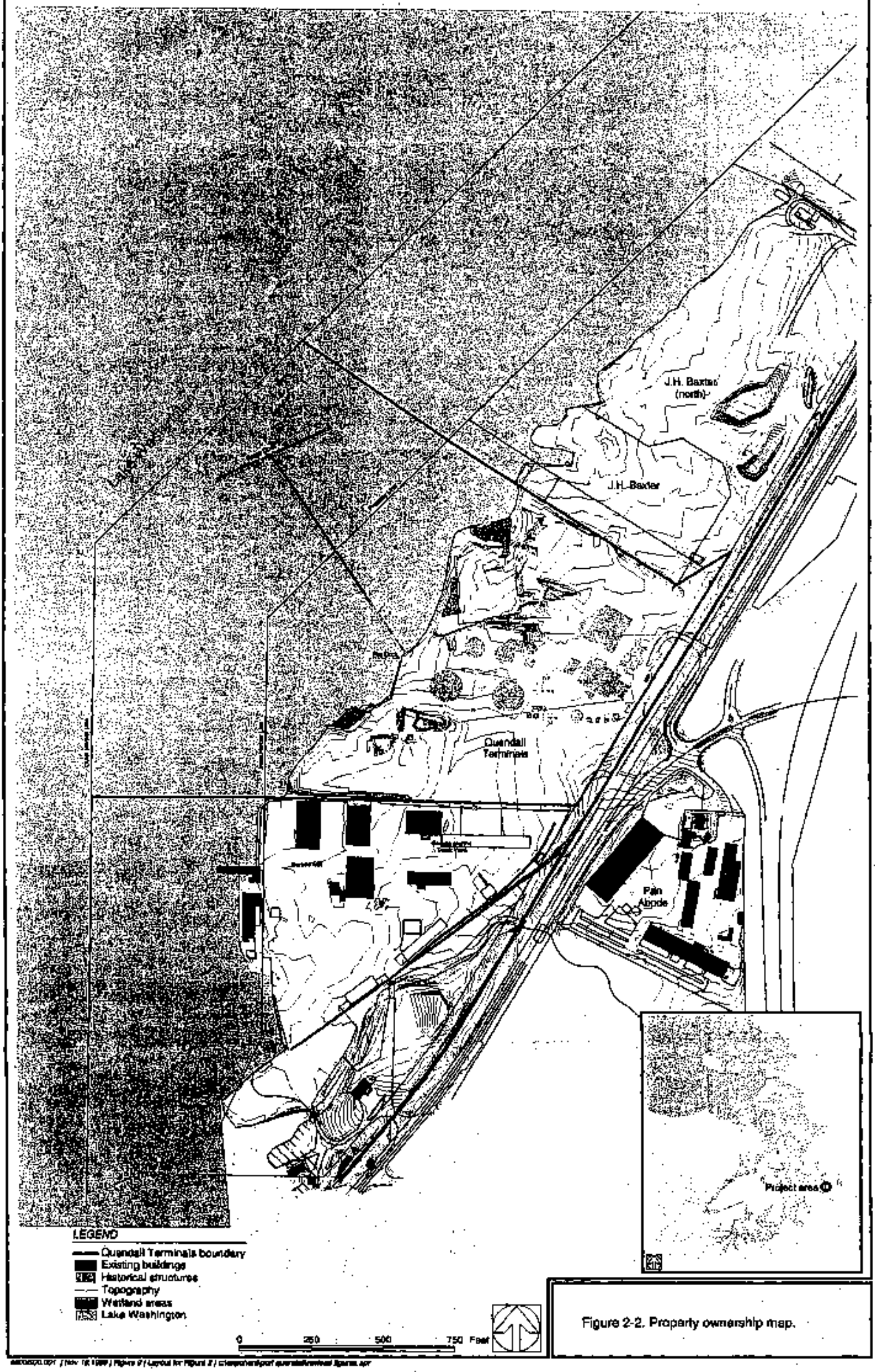


Figure 2-2. Property ownership map.

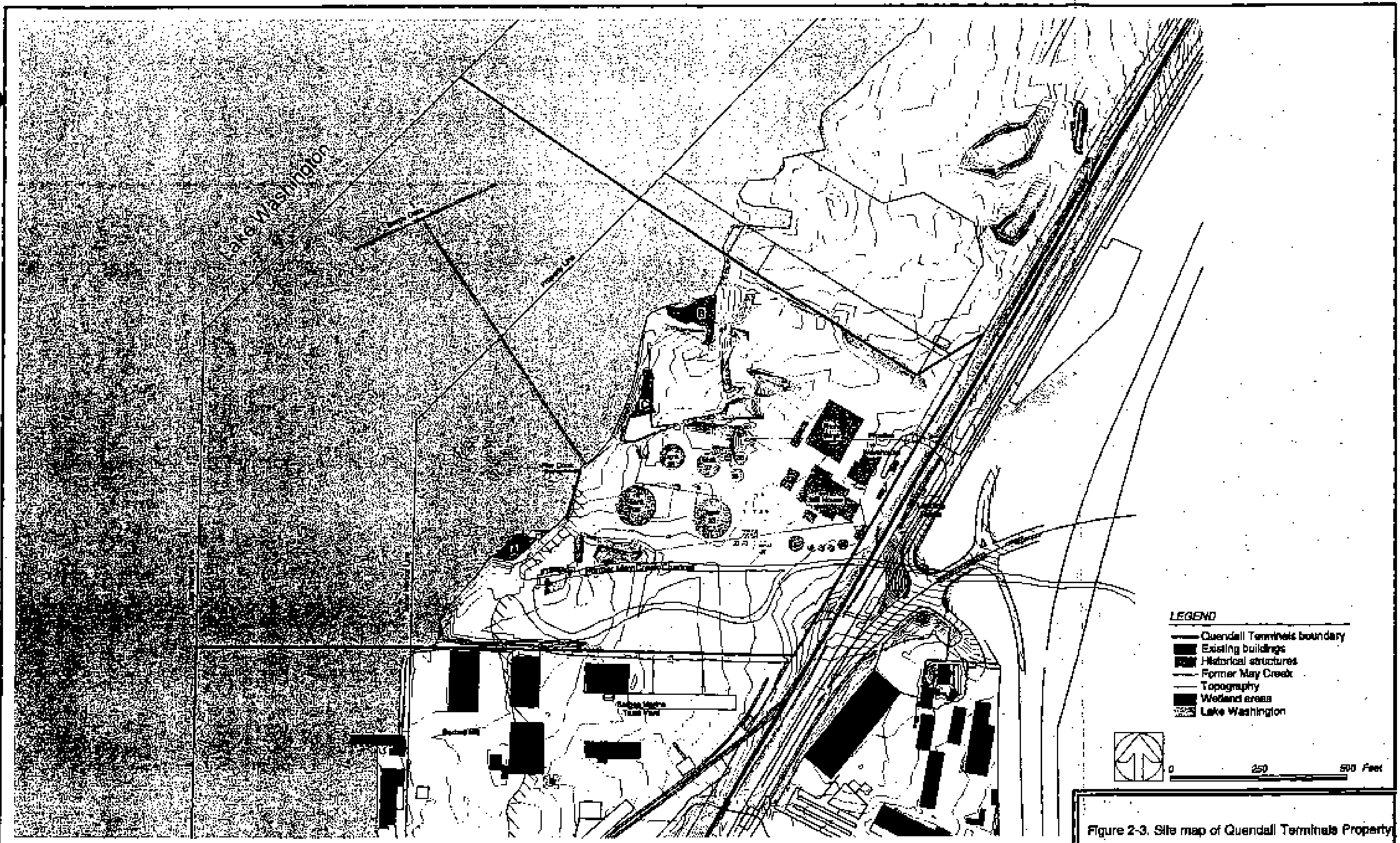


Figure 2-3. Site map of Quendall Terminals Property

Source: RETEC (1998)

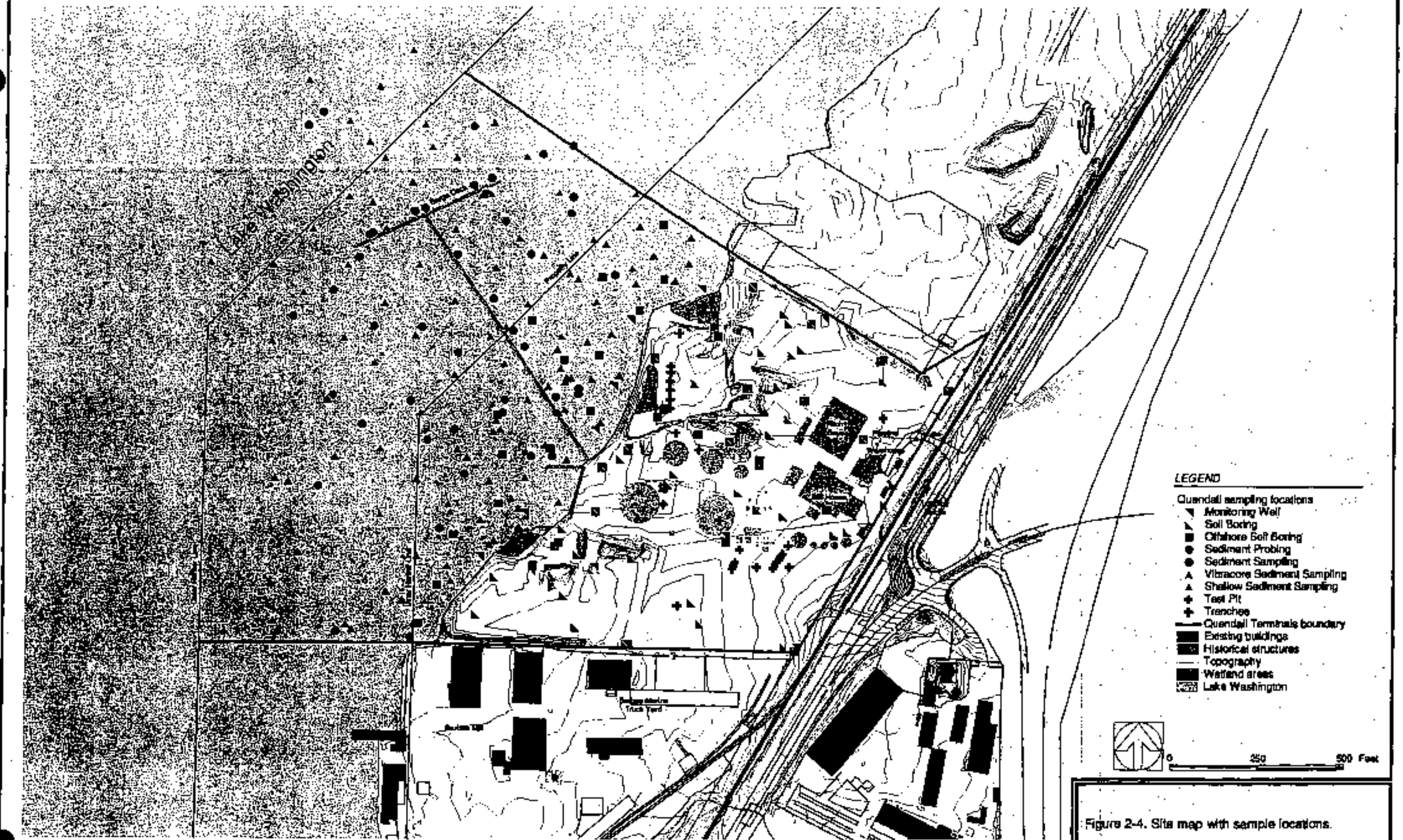
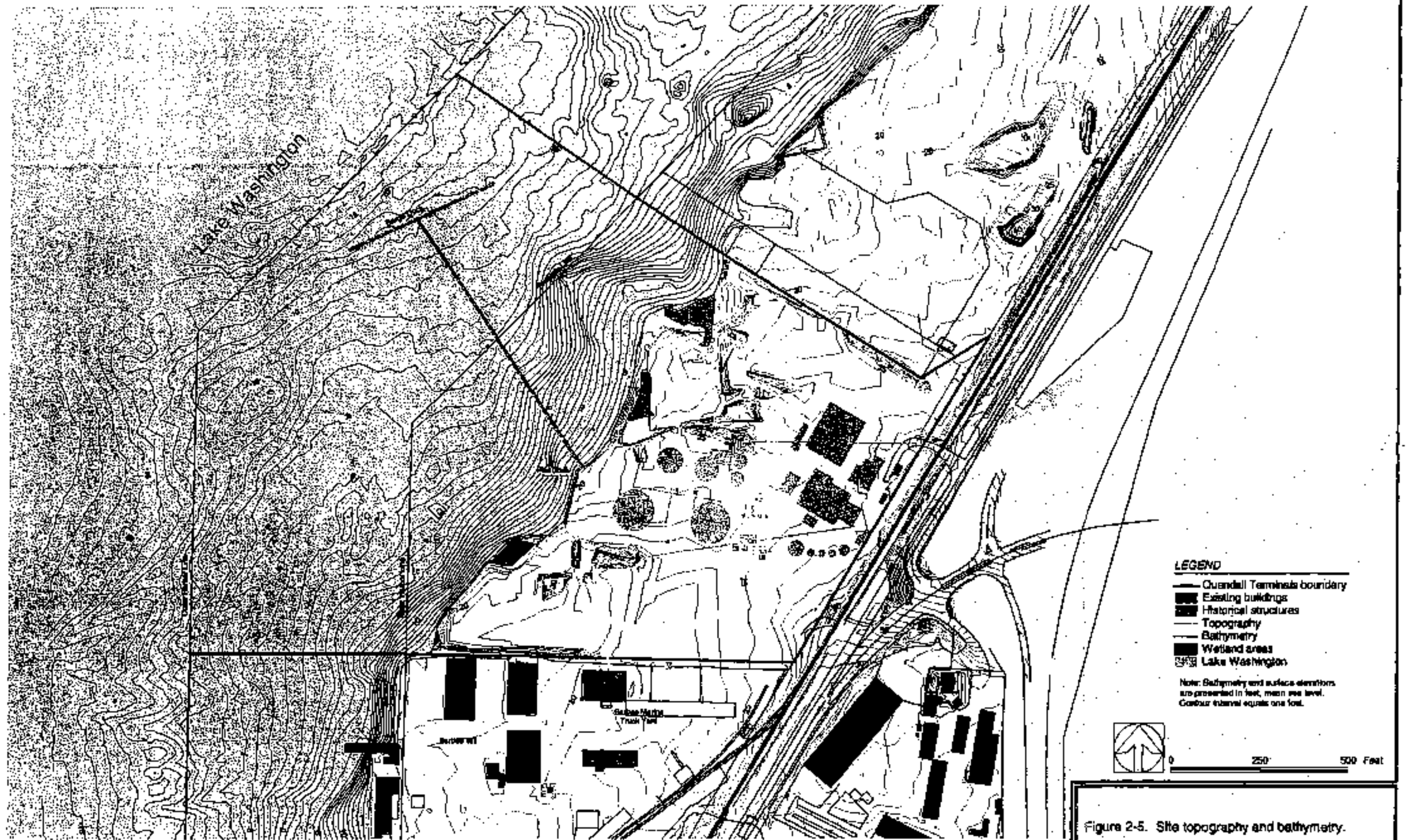


Figure 2-4. Site map with sample locations.

Source: RETEC (1998)



Source: RETEC (1998)

Figure 2-5. Site topography and bathymetry.

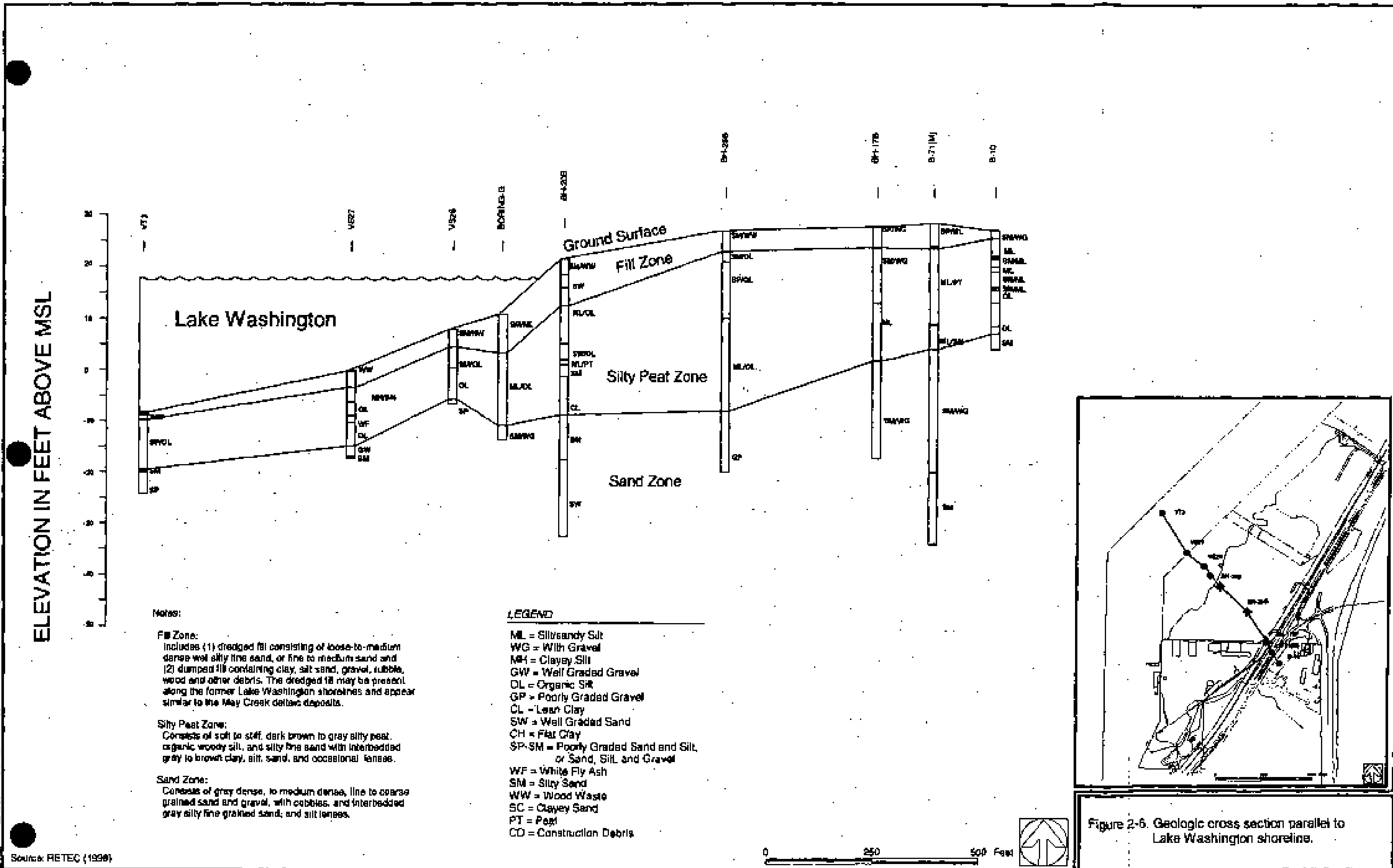


Figure 2-6. Geologic cross section parallel to Lake Washington shoreline.

SOUTH

A

ELEVATION IN FEET ABOVE MSL

SWB-10 RMW-5 RSB-7 SWB-7 RSB-3 HC-6 BH-21B SWB-9 BH-12 BH-19 BH-20B BH-5 BH-18B SWB-8B BAX-86

FILL ZONE

SILTY PEAT ZONE

SAND ZONE

NO RECOVERY

LEGEND

ML = Silt/sandy Silt
WG = With Gravel
MH = Clayey Silt
GW = Well Graded Gravel
OL = Organic Silt
GP = Poorly Graded Gravel
CL = Lean Clay
SW = Well Graded Sand
CH = Fat Clay
SP-SM = Poorly Graded Sand and Silt, or Sand, Silt, and Gravel
WF = White Fly Ash
SM = Silty Sand
WW = Wood Waste
SC = Clayey Sand
PT = Peat
CD = Construction Debris

Notes:

Fill Zone:
Includes (1) dredged fill consisting of loose-to-medium dense wet silty fine sand, or fine to medium sand and (2) dumped fill containing clay, silt sand, gravel, rubble, wood and other debris. The dredged fill may be present along the former Lake Washington shorelines and appear similar to the May Creek deltaic deposits.

Silty Peat Zone:
Consists of soft to stiff, dark brown to gray silty peat, organic woody silt, and silty fine sand with interbedded gray to brown clay, silt, sand, and occasional lenses.

Sand Zone:
Consists of gray dense, to medium dense, fine to coarse grained sand and gravel, with cobbles, and interbedded gray silty fine grained sand, and silt lenses.

0 250 500 Feet

Source: RETEC (1996)

Figure 2-7. Geologic cross section perpendicular to Lake Washington shoreline.

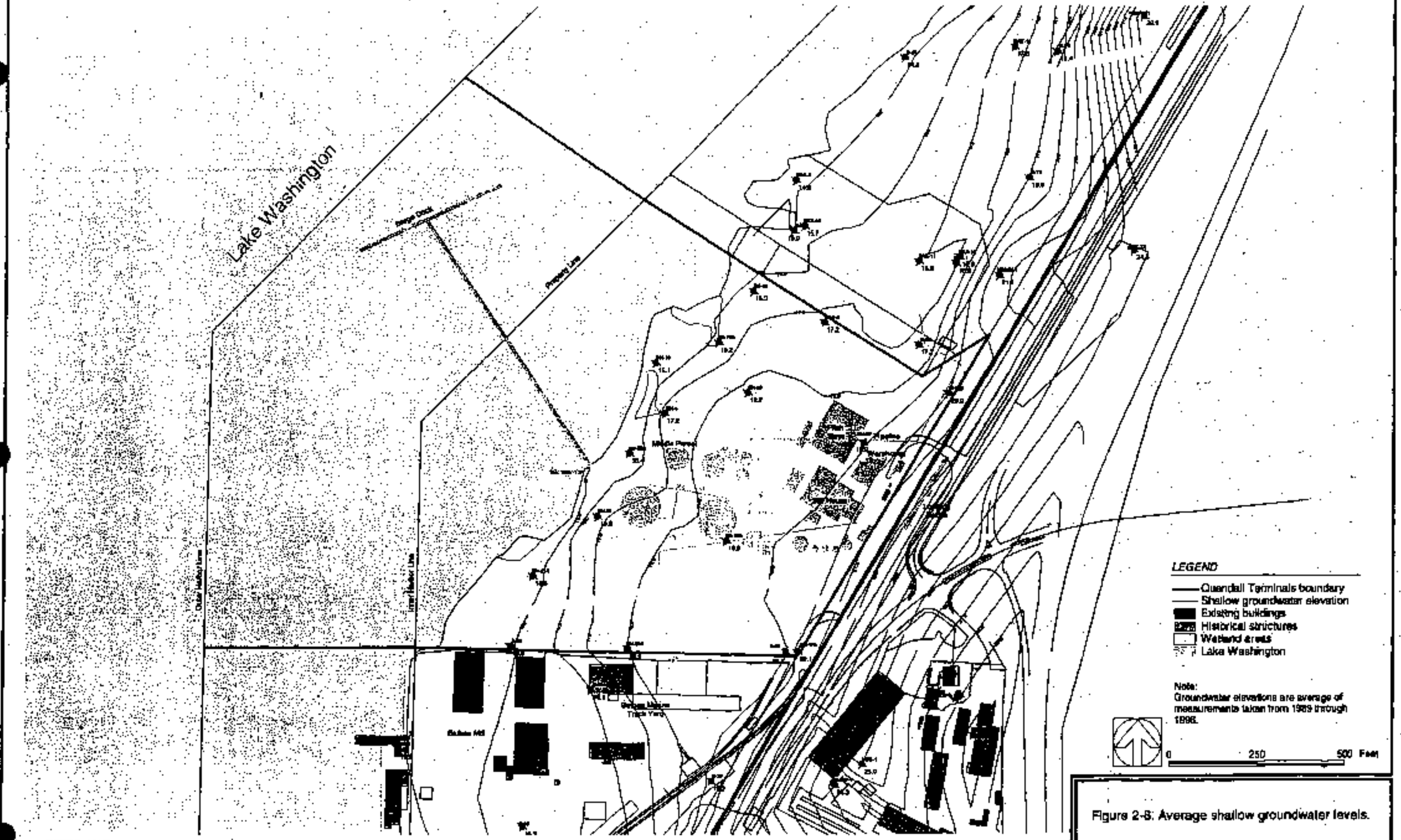
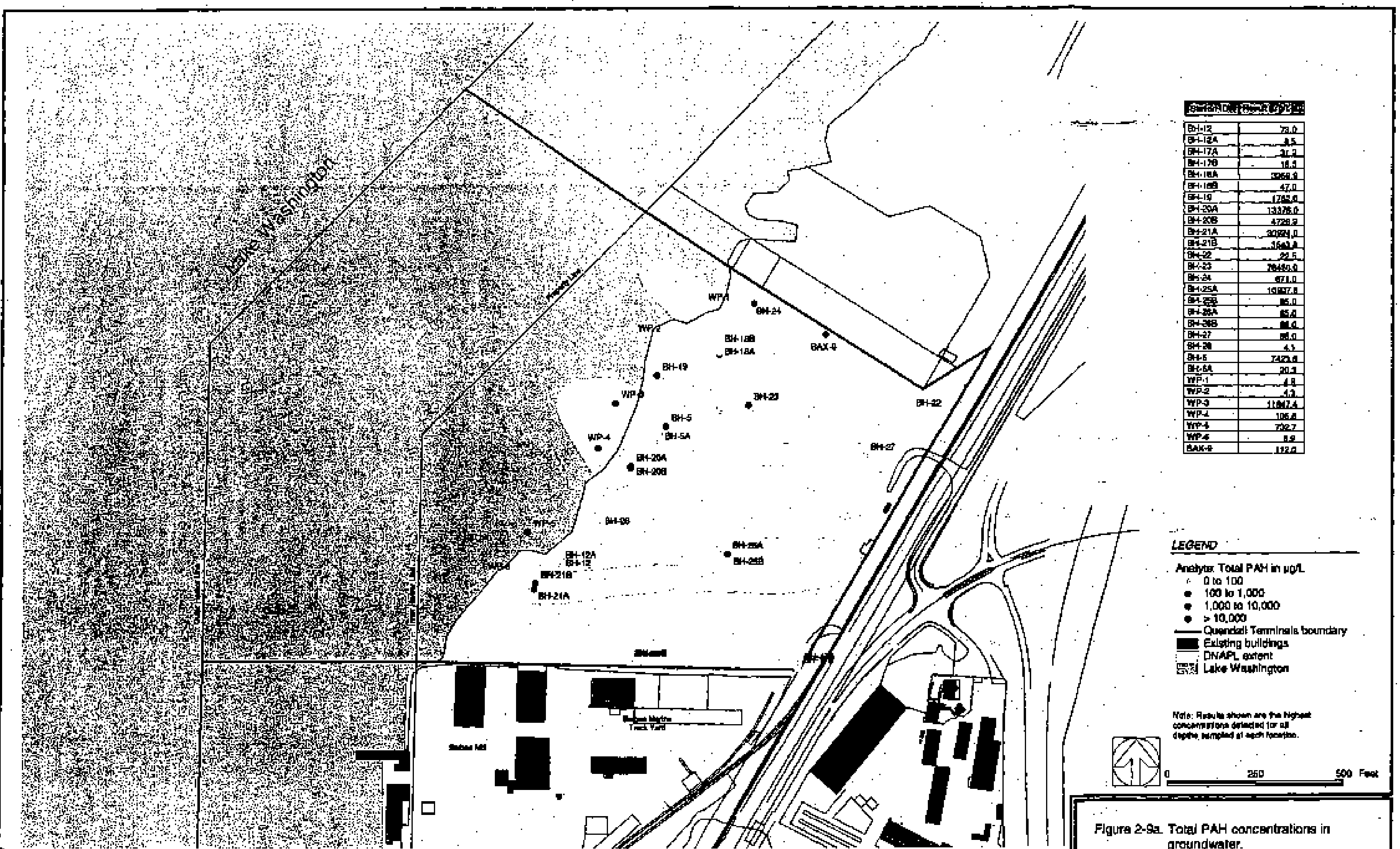


Figure 2-8: Average shallow groundwater levels.

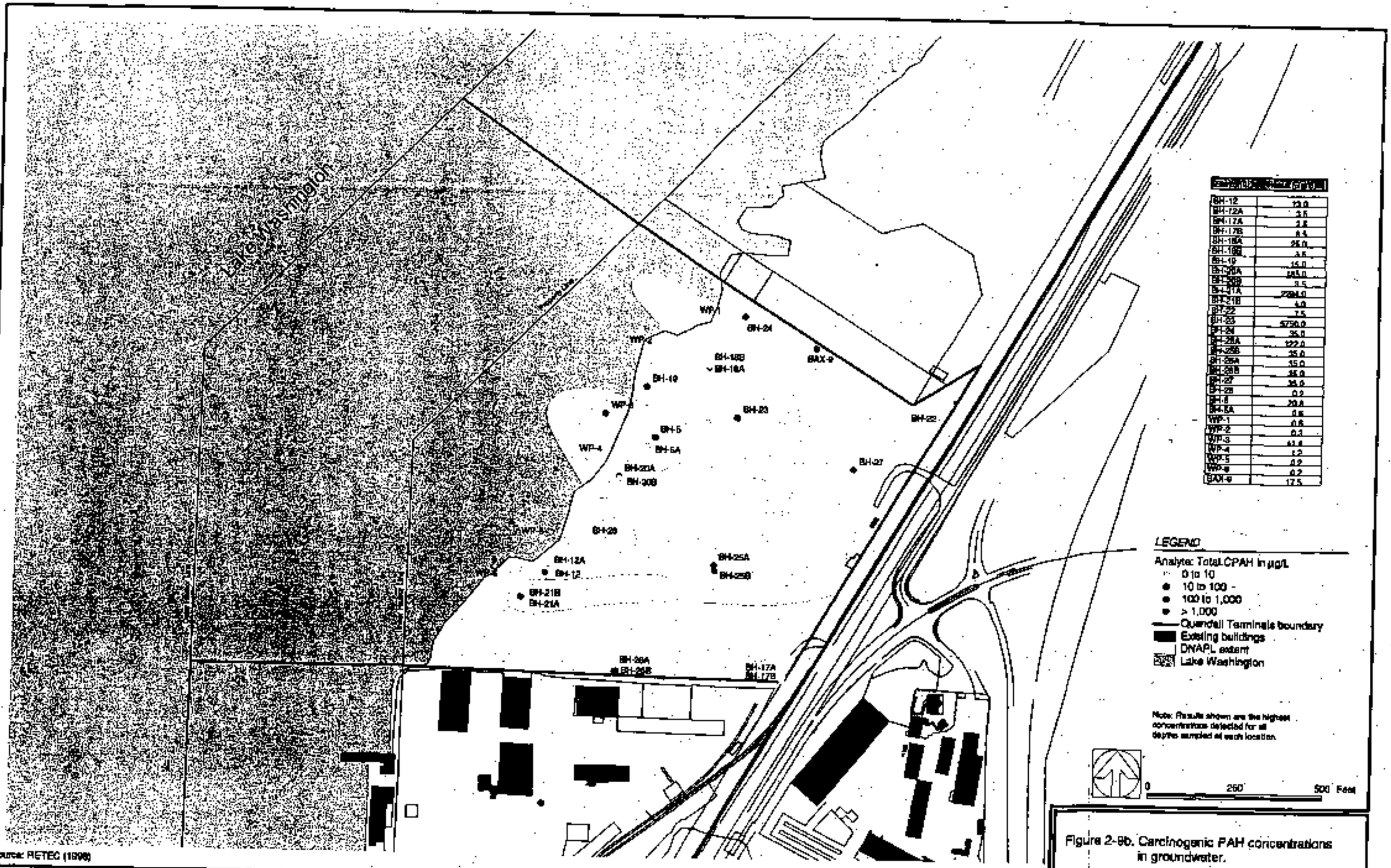
Source: RETEC (1999)



Station ID	Result (µg/L)
BH-12	73.0
BH-12A	8.5
BH-17A	31.2
BH-17B	16.3
BH-18A	3269.9
BH-18B	47.0
BH-19	1782.0
BH-20A	13376.0
BH-20B	4728.9
BH-21A	30924.0
BH-21B	1643.4
BH-22	22.5
BH-23	78450.0
BH-24	671.0
BH-25A	10927.8
BH-25B	85.0
BH-26A	85.0
BH-26B	88.0
BH-27	86.0
BH-28	4.1
BH-5	7421.6
BH-5A	20.3
WP-1	4.8
WP-2	4.3
WP-3	11847.4
WP-4	106.8
WP-5	732.7
WP-6	8.9
BAX-9	112.0

Figure 2-9a. Total PAH concentrations in groundwater.

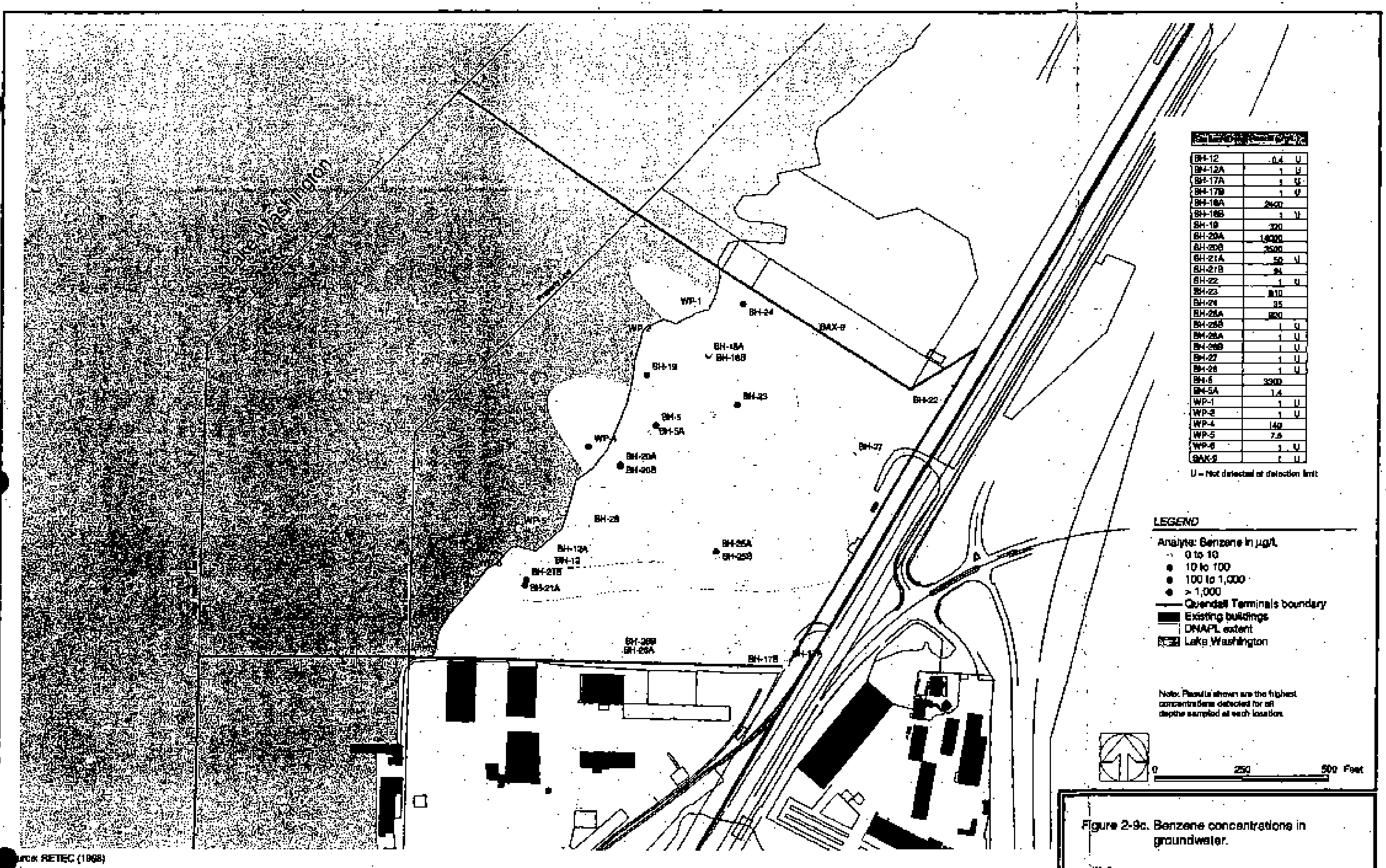
Source: RETEC (1996)



BH-12	13.0
BH-12A	3.5
BH-17A	3.8
BH-17B	8.4
BH-18A	95.0
BH-18B	3.5
BH-19	14.0
BH-20A	145.0
BH-20B	3.5
BH-21A	2384.0
BH-21B	4.0
BH-22	7.5
BH-23	5750.0
BH-24	35.0
BH-25A	122.0
BH-25B	35.0
BH-26A	35.0
BH-26B	35.0
BH-27	35.0
BH-28	0.2
BH-5	20.8
BH-5A	0.6
WP-1	0.6
WP-2	0.3
WP-3	61.6
WP-4	1.2
WP-5	0.2
WP-6	0.2
BAX-9	17.5

Figure 2-9b. Carcinogenic PAH concentrations in groundwater.

Source: RETEC (1998)

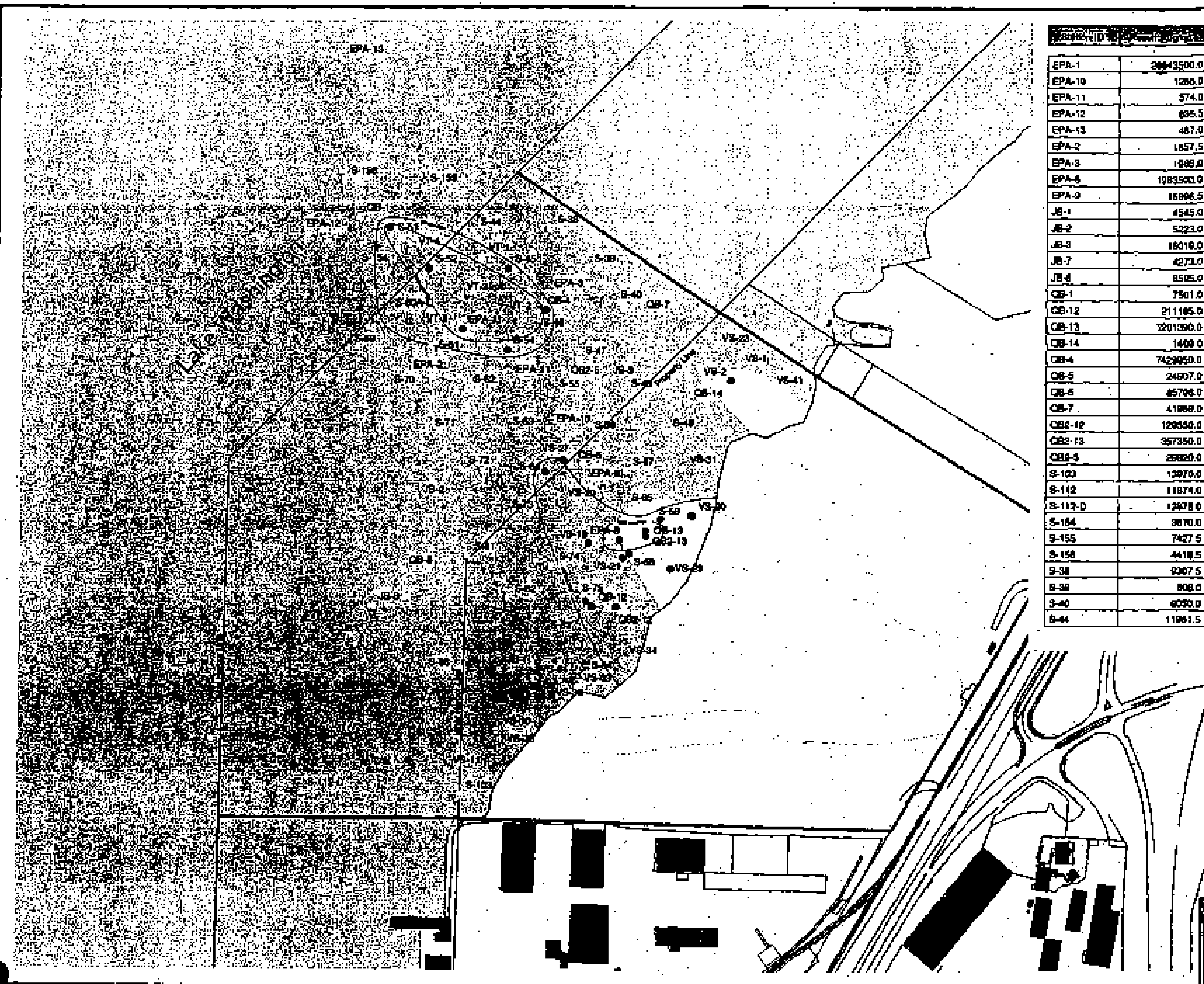


[illegible]	[illegible]
BH-12	0.4 U
BH-12A	1 U
BH-17A	1 U
BH-17B	1 U
BH-18A	2400
BH-18B	1 U
BH-19	320
BH-20A	14000
BH-20B	3500
BH-21A	50 U
BH-21B	94
BH-22	1 U
BH-23	810
BH-24	35
BH-25A	920
BH-25B	1 U
BH-26A	1 U
BH-26B	1 U
BH-27	1 U
BH-28	1 U
BH-5	3300
BH-5A	1.4
WP-1	1 U
WP-2	1 U
WP-4	140
WP-5	7.6
WP-6	1 U
SAX-9	1 U

U = Not detected at detection limit

Figure 2-9c. Benzene concentrations in groundwater.

Source: RETEC (1998)



EPA-1	28643500.0	S-45	661770.0	S-81	27862.0
EPA-10	1260.0	S-46	325800.0	S-82	35410.0
EPA-11	574.0	S-46B-D	351830.0	S-83	27770.0
EPA-12	635.5	S-47	16728.0	S-84	27081.0
EPA-13	487.0	S-48	26050.0	S-86	5702.5
EPA-2	1857.5	S-49	53083.0	VS-1	523.0
EPA-3	1989.0	S-51	1700160.0	VS-10	3677.5
EPA-6	1983500.0	S-52	1708880.0	VS-11	9143.0
EPA-9	15896.5	S-54	486670.0	VS-18	200836.0
JB-1	4545.0	S-55	10037.5	VS-2	1992000.0
JB-2	5223.0	S-56	25187.5	VS-20	139.8
JB-3	16010.0	S-57	68345.0	VS-20	205806.0
JB-7	4273.0	S-58	125845.0	VS-21	482320.0
JB-8	8505.0	S-60	188770.0	VS-23	4022.0
QB-1	7501.0	S-60A-D	19083.5	VS-27	318280.0
QB-12	211105.0	S-61	36058.5	VS-29	1436600.0
QB-13	1201390.0	S-62	32788.0	VS-30	15230000.0
QB-14	1409.0	S-63	34345.0	VS-31	17942.5
QB-4	7429050.0	S-64	143405.5	VS-33	58310.0
QB-5	24607.0	S-65	68670.0	VS-34	62073.0
QB-6	45796.0	S-66	125280.0	VS-35	21940.0
QB-7	41968.0	S-69	5801.0	VS-36	22182.5
QB2-12	129550.0	S-70	15870.0	VS-41	2170.0
QB2-13	357350.0	S-71	18730.0	VS-9	5347.5
QB3-5	25820.0	S-72	6893.0	VT-1	17118.4
S-103	13970.0	S-73	40440.0	VT-2	683.0
S-112	11874.0	S-74	66460.0	VT-3	990.0
S-112-D	12978.0	S-75	100232.5	VT-4	34840.0
S-154	3670.0	S-76	6492.0	VT-5	748.0
S-155	7427.5				
S-156	4418.5				
S-38	9307.5				
S-39	808.0				
S-40	6050.0				
S-44	11961.5				

LEGEND

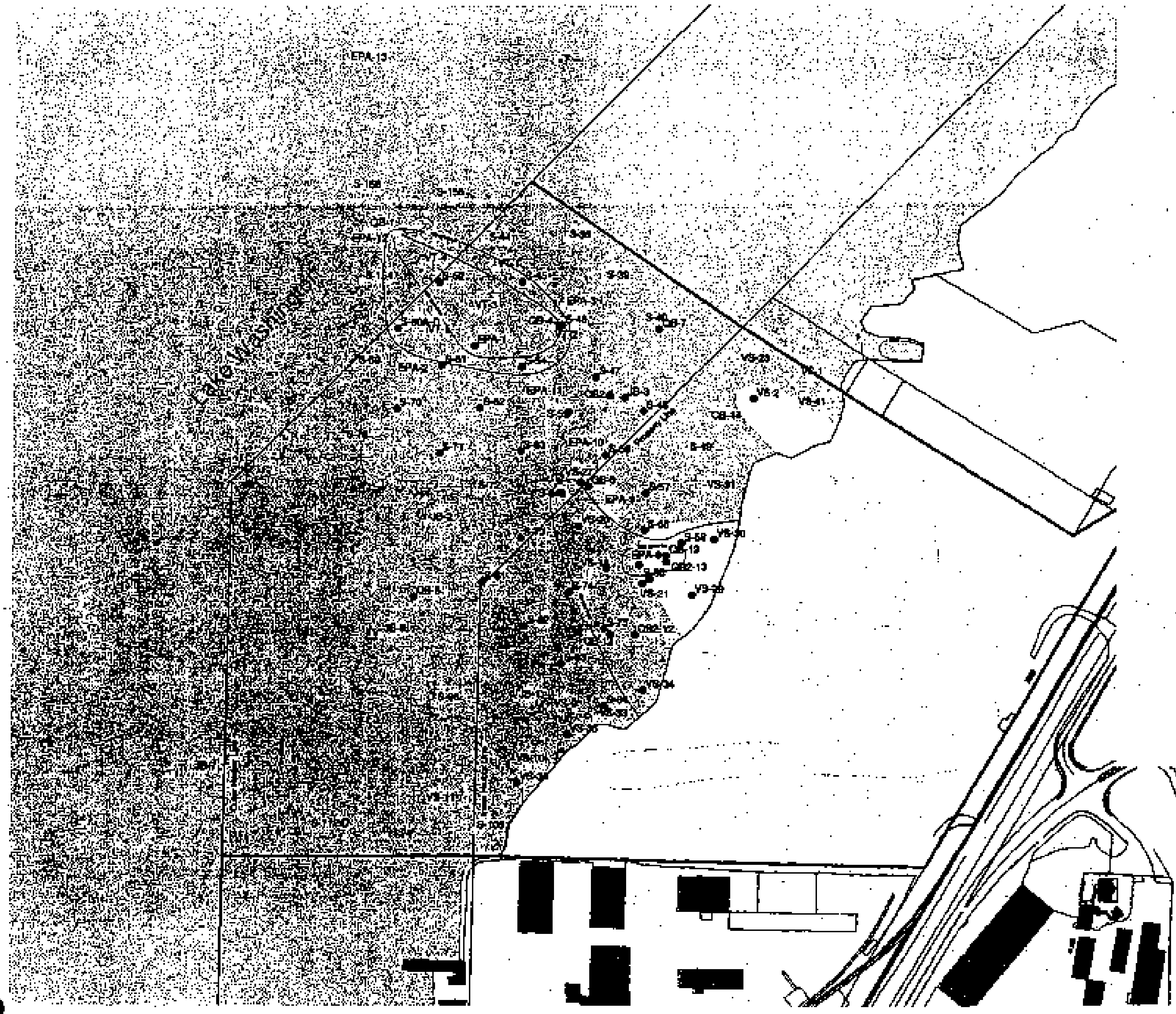
Analyte: Total PAH in µg/kg (EPA Method 8270)

- 0 to 100,000
- 100,000 to 1,000,000
- 1,000,000 to 10,000,000
- > 10,000,000
- Quendall Terminals boundary
- Existing buildings
- DNAPL extent
- Lake Washington
- PAH isopleths for shallow sediments from Phase 1 sampling 100 ppm = 100,000 µg/kg (RETEC 1997)

Note: Results shown are the highest concentrations detected for all depths sampled at each location.

0 250 500 Feet

Figure 2-10a. Total PAH concentrations in sediment.



Station ID	[illegible]
EPA-1	9412500.0
EPA-10	880.0
EPA-11	430.0
EPA-12	512.5
EPA-13	312.5
EPA-2	1192.5
EPA-3	4282.5
EPA-8	762000.0
EPA-9	7170.0
JB-1	2695.0
JB-2	3860.0
JB-3	11140.0
JB-7	2835.0
JB-9	5990.0
QB-1	4760.0
QB-12	114125.0
QB-13	717050.0
QB-14	825.0
QB-4	985050.0
QB-5	12880.0
QB-6	62600.0
QB-7	25285.0
QB2-12	92400.0
QB2-13	237900.0
QB2-5	20890.0
S-103	8080.0
S-112	5120.0
S-112-D	7580.0
S-154	2780.0
S-156	5130.0
S-158	3070.0
S-38	6490.0
S-39	548.0
S-40	6120.0
S-44	7840.0
S-45	217000.0
S-46	80200.0
S-46B-D	133800.0
S-47	11000.0
S-48	20820.0
S-49	8170.0
S-51	6430.0
S-52	388100.0
S-54	182700.0
S-56	15120.0
S-58	17870.0
S-57	54100.0
S-58	108100.0
S-60	74200.0
S-60A-D	12270.0

Station ID	[illegible]
S-61	23620.0
S-62	21520.0
S-63	21520.0
S-64	120400.0
S-65	49900.0
S-66	98700.0
S-69	4140.0
S-70	10650.0
S-71	11400.0
S-72	4230.0
S-73	20500.0
S-74	43800.0
S-75	66300.0
S-78	3580.0
S-81	22540.0
S-82	18210.0
S-89	15370.0
S-94	13390.0
S-96	3255.0
VS-1	232.5
VS-10	1484.0
VS-11	5170.0
VS-18	127500.0
VS-2	234500.0
VS-20	122000.0
VS-21	284000.0
VS-23	128.0
VS-27	205000.0
VS-29	248500.0
VS-30	3078000.0
VS-31	511.0
VS-33	1120.0
VS-34	40900.0
VS-35	12890.0
VS-36	10480.0
VS-41	840.0
VS-9	2704.0
VT-1	2760.0
VT-2	273.0
VT-3	368.0
VT-4	7830.0
VT-5	308.0

LEGEND

Analyte: Total CPAH in µg/kg
(EPA Method 8270)

- 0 to 10,000
- 10,000 to 100,000
- 100,000 to 1,000,000
- > 1,000,000
- Quendall Terminals boundary
- Existing buildings
- DNAPL extent
- Lake Washington
- PAH isopleths for shallow sediments from Phase 1 sampling. 100 ppm = 100,000 µg/kg (RETEC 1997)

Note: Results shown are the highest concentrations detected for all depths sampled at each location.

0 250 500 Feet

Figure 2-10b. Carcinogenic PAH concentrations in sediment.

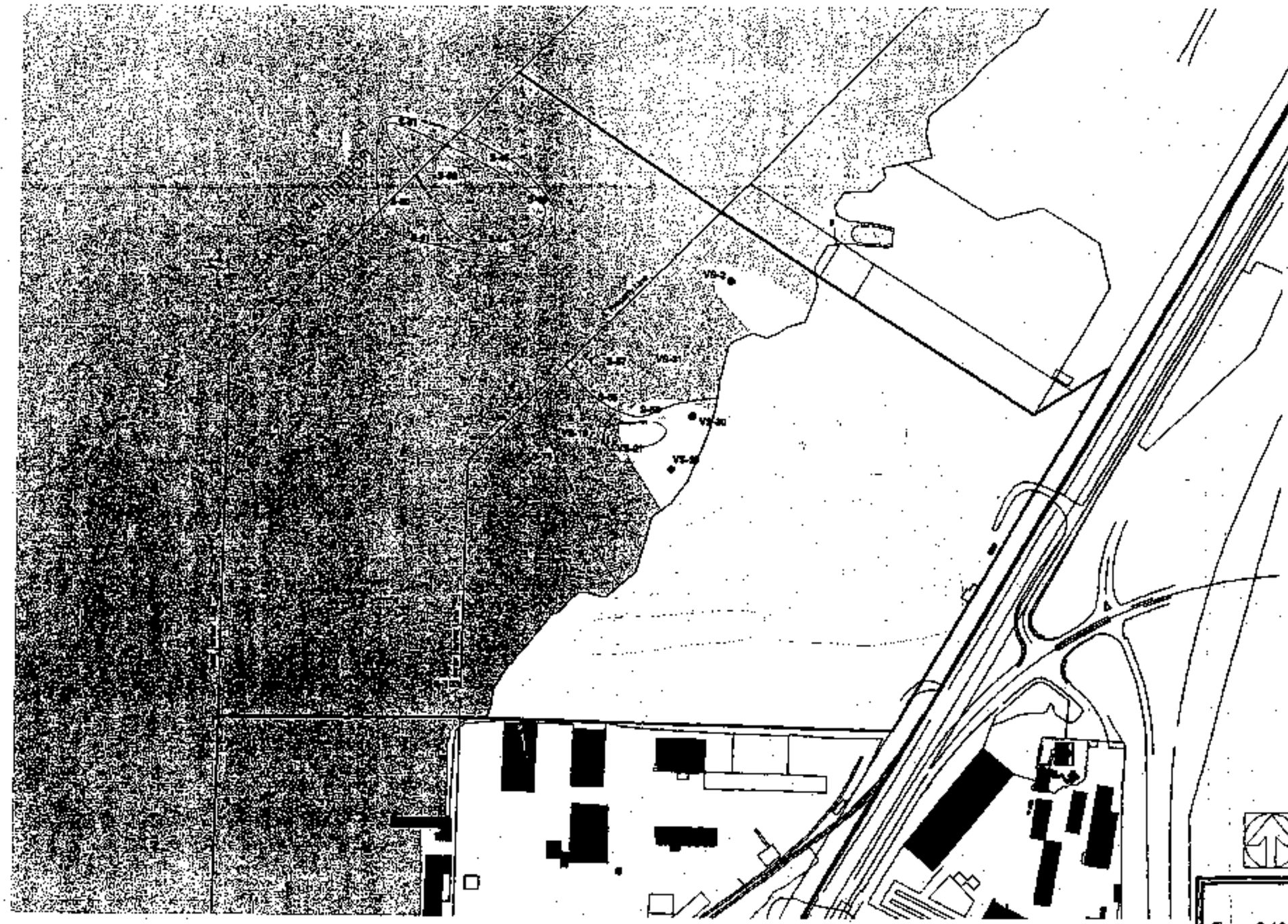
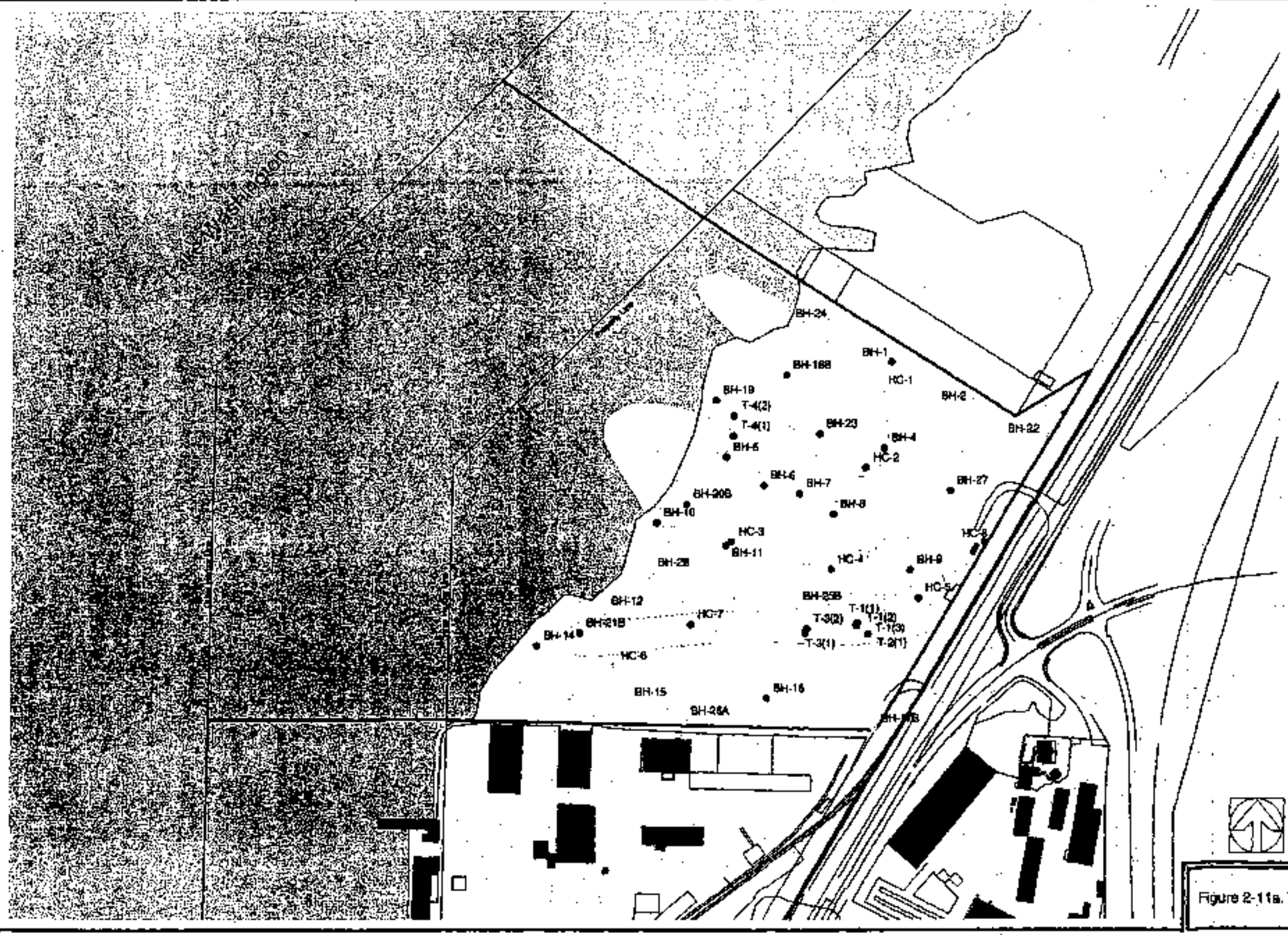


Figure 2-10c. Benzene concentrations in sediment.

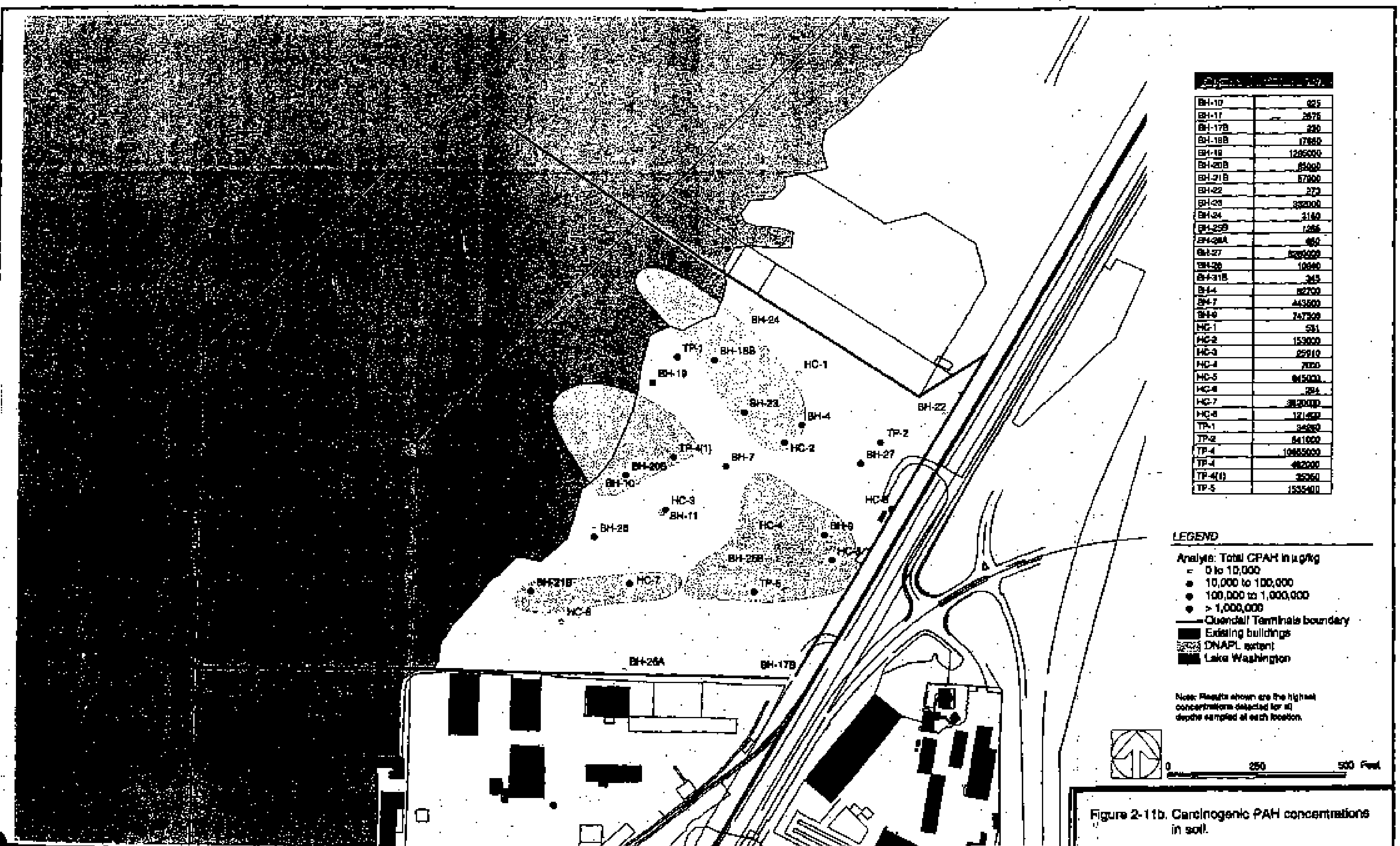


Station	Total PAH (µg/kg)
BH-1	48000000
BH-10	6300000
BH-11	170000
BH-12	40000
BH-14	220000
BH-15	80000
BH-16	110000
BH-17B	317
BH-18B	201190
BH-19	3314000
BH-2	30000
BH-20B	103580
BH-21B	356020
BH-22	6240
BH-23	4127000
BH-24	1180
BH-25B	3830
BH-26A	220
BH-27	13569000
BH-28	100000
BH-3B	500
BH-4	34000000
BH-5	19000000
BH-6	10000000
BH-7	5700000
BH-8	18000000
BH-9	22000000
HC-1	18000
HC-2	1250000
HC-3	490000
HC-4	120000
HC-5	7646000
HC-6	5300
HC-7	1250000
HC-8	1250000
T-1(1)	20000
T-1(2)	3700000
T-1(3)	7300000
T-2(1)	50000000
T-3(1)	10000000
T-3(2)	12000000
T-4(1)	19000000
T-4(2)	17000000

LEGEND

Analyte: Total PAH in µg/kg
- 0 to 100,000
- 100,000 to 1,000,000
- 1,000,000 to 10,000,000
- > 10,000,000

Figure 2-11a. Total PAH concentrations in soil.



[illegible]	
BH-10	925
BH-11	2575
BH-17B	230
BH-18B	17680
BH-19	1285000
BH-20B	85000
BH-21B	57900
BH-22	273
BH-23	332000
BH-24	3140
BH-25B	1265
BH-26A	460
BH-27	8280000
BH-28	10640
BH-31B	345
BH-4	82700
BH-7	443500
BH-9	747500
HC-1	591
HC-2	153000
HC-3	25910
HC-4	7050
HC-5	845000
HC-6	294
HC-7	3820000
HC-8	121400
TP-1	34260
TP-2	841000
TP-4	10665000
TP-4	482000
TP-4(1)	35360
TP-5	1535400

Figure 2-11b. Carcinogenic PAH concentrations in soil.

[illegible]

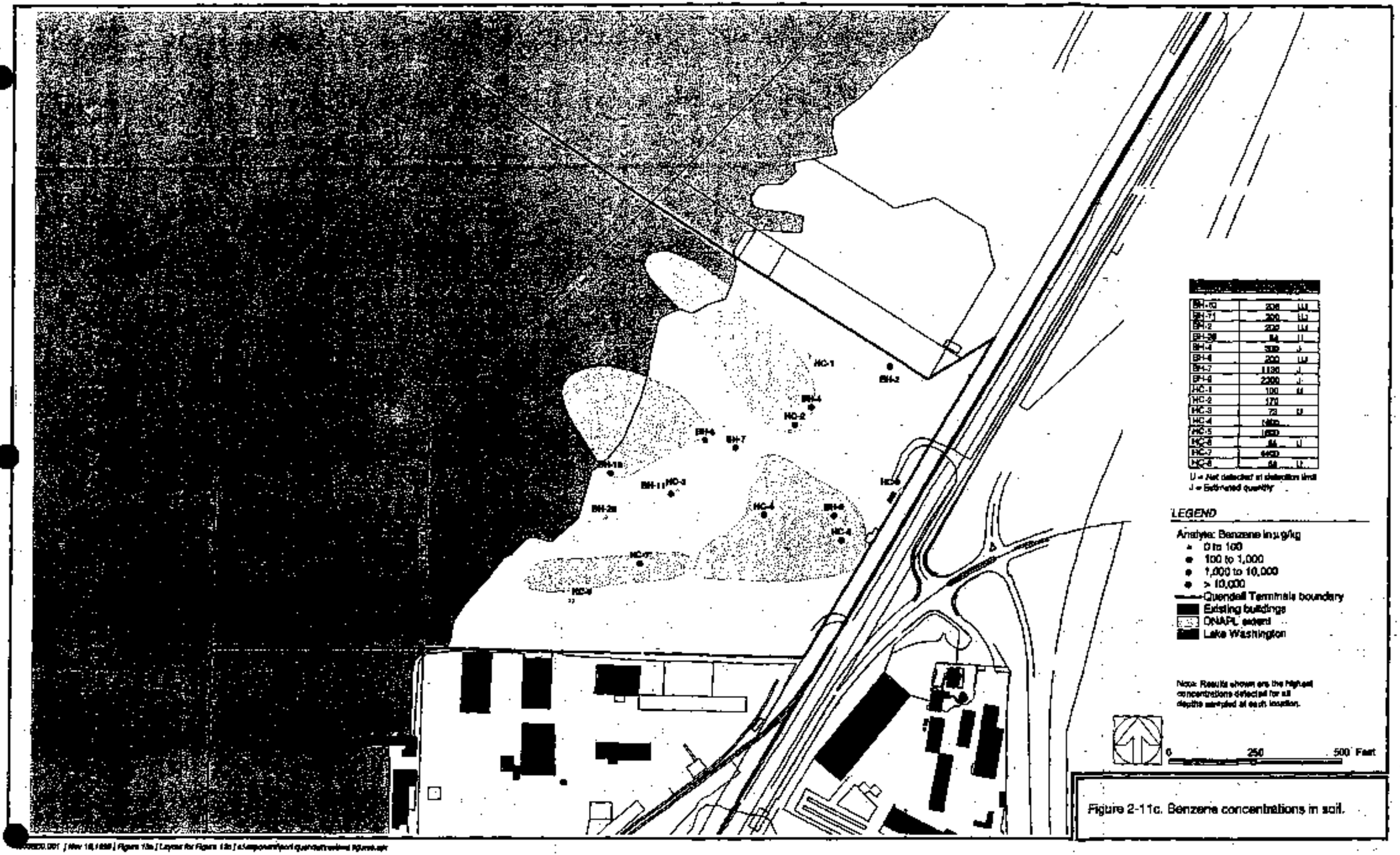


Figure 2-11c. Benzene concentrations in soil.

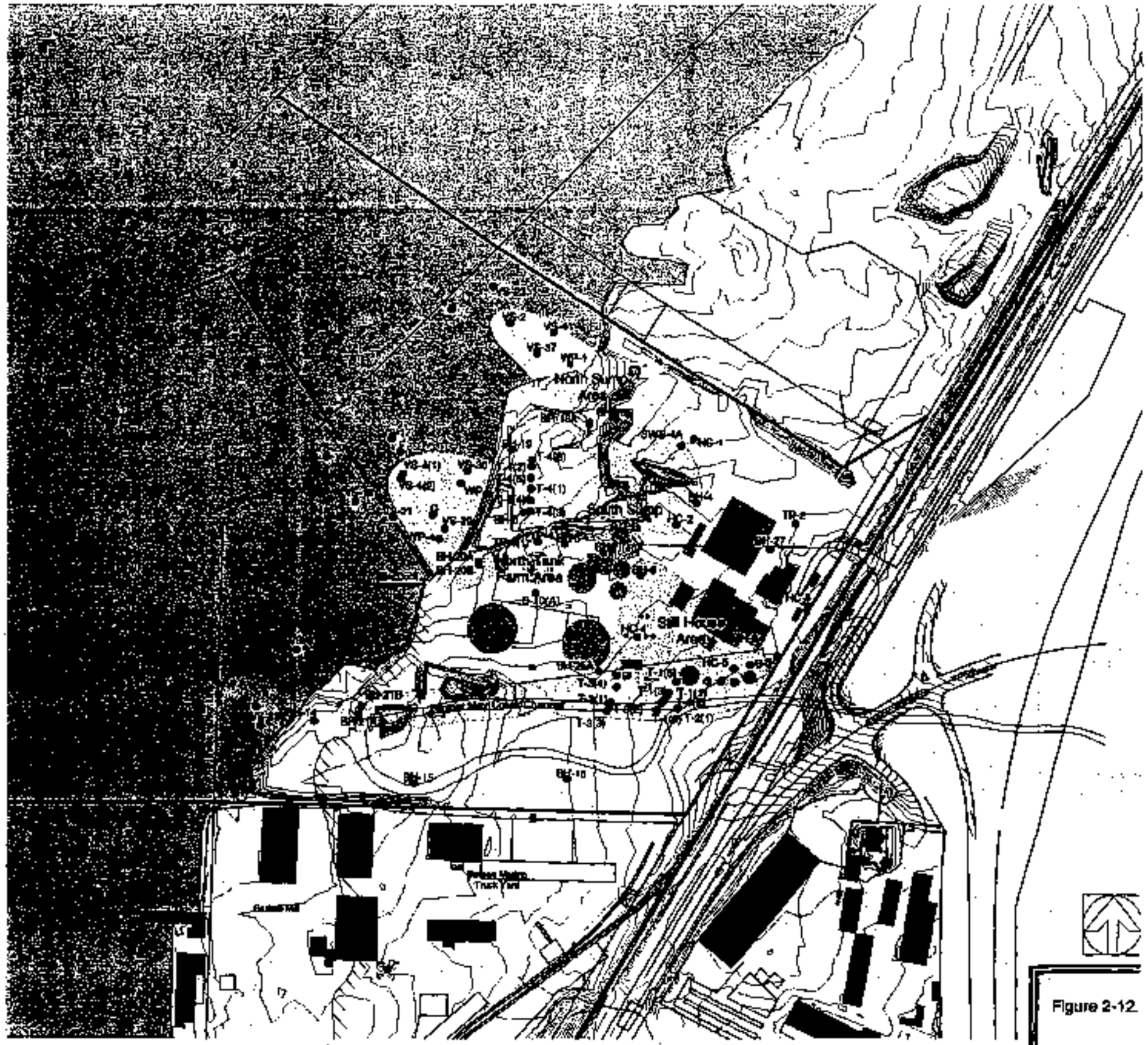

North Sump
South Sump
Existing Tank Farm Area
Still House Area
Refuse Waste Truck Yard

Figure 2-12

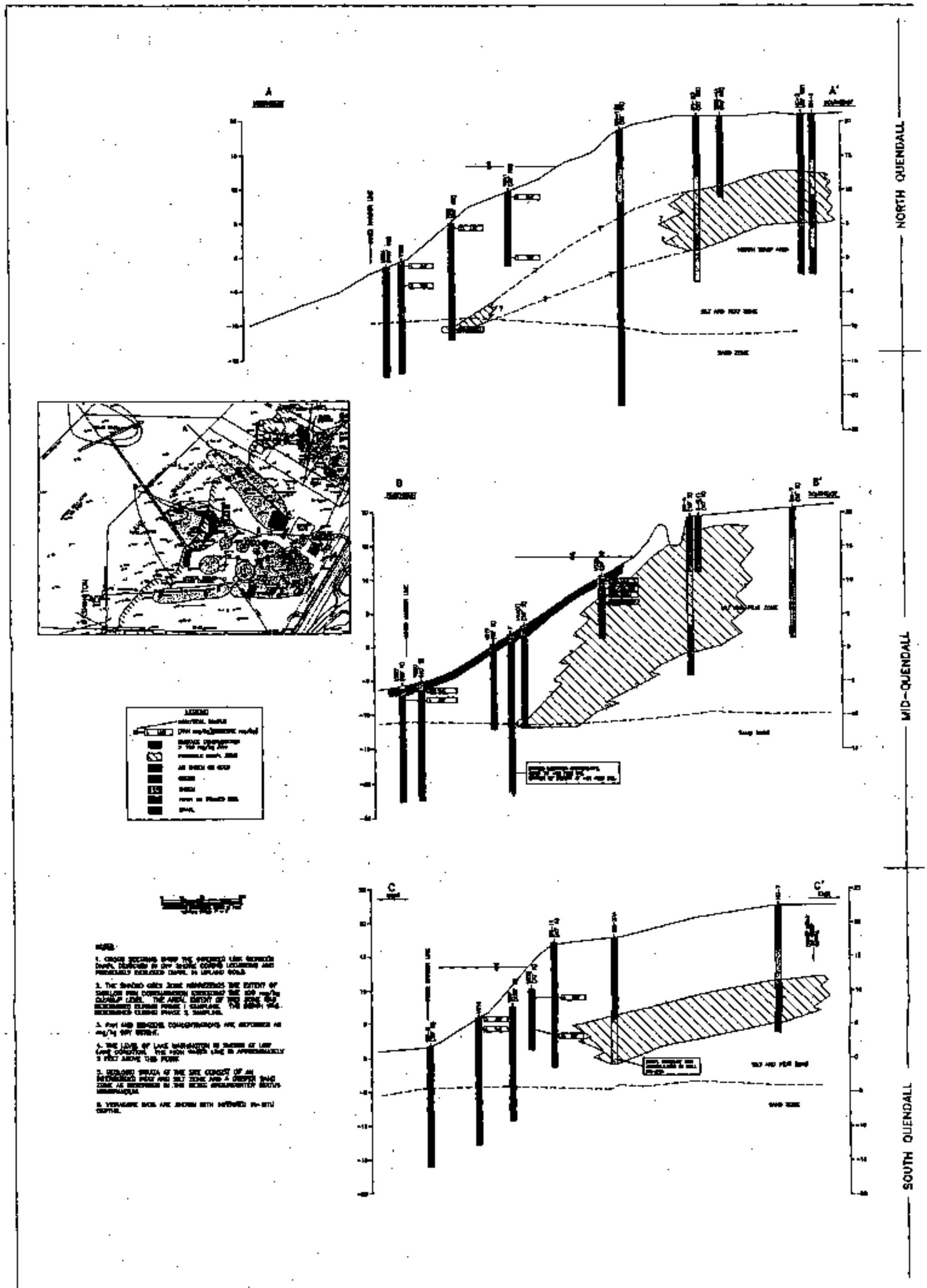


Figure 2-13. Cross section of DNAPL concentrations in soil.

Figure 2-14.

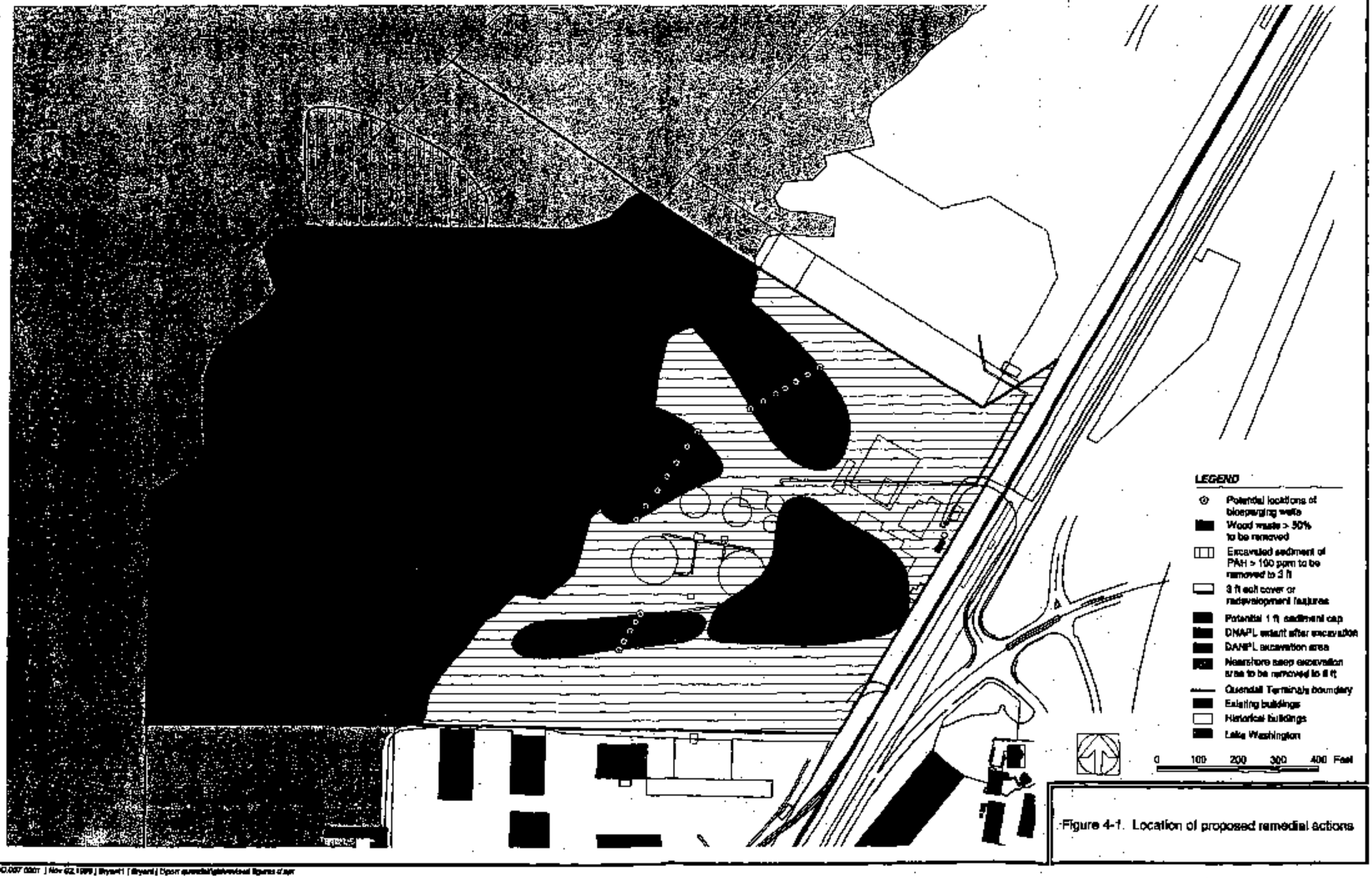


Figure 4-1. Location of proposed remedial actions

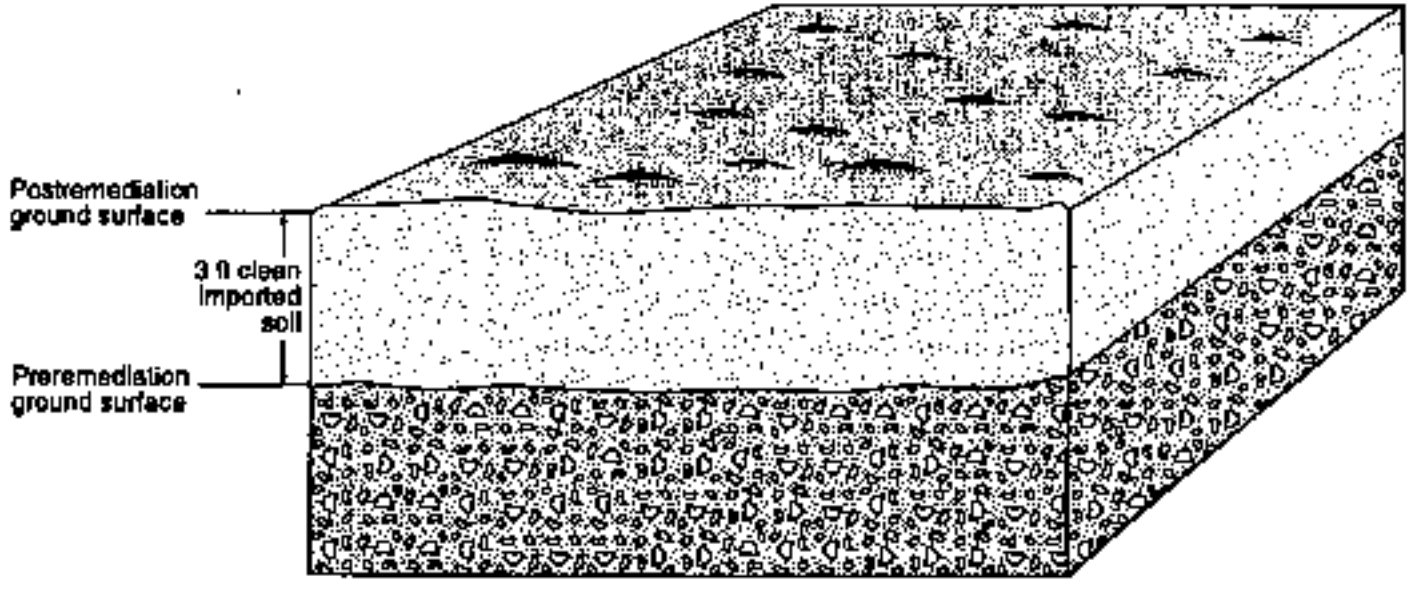


Figure 4-2. Schematic cross section of soil cap

Figure 4-3 will be provided

Table

Table 4-1. Summary of proposed remedial action alternatives

	Proposed Remedial Action	Remedial Action Objectives Addressed by Action
Upland Soils	3-ft-thick clean soil cap over site areas that will not be covered by site redevelopment features (e.g., parking lots, buildings).	Prevent human exposure through direct contact with CoCs in surface soils that exceed protective levels.
Upland Subsurface DNAPL	DNAPL recovery trenches. Recycle/treat recovered DNAPL. Institutional controls related subsurface activity.	Reduce the mass and migration of subsurface DNAPL.
Groundwater	Source removal, capping with biosparging as a contingency remedy.	Reduce migration of CoCs to Lake Washington.
DNAPL beneath Lake Washington		
North Sump	Monitoring to ensure existing natural sediments and soils provide sufficient cover to meet RAO.	Prevent future human exposure to groundwater and soil exceeding protective levels.
Nearshore Seep	Excavate to maximum depth of 6 ft below mud line. Dewater and thermal treatment.	Reduce the mass of CoCs in surface sediments, enhance sediment habitat, and prevent the migration of subsurface DNAPL to the sediments.
Nearshore Sediments (>100 mg/kg PAH dry weight)	Dredge to 3 ft, dewater, treatment and/or offsite landfill disposal. Excavated area will be backfilled.	Reduce adverse biological impacts.
T-dock Sediments (>100 mg/kg PAH dry weight)	Dredge to 3 ft, dewater, treatment and/or offsite landfill disposal. Excavated area will be backfilled.	Reduce adverse biological impacts.
>50 Percent Wood Waste Sediment	Remove, dewater, recycle as practicable or offsite landfill disposal. No backfill.	Reduce the mass of wood waste in surface sediments and reduce deleterious effects.
<50 Percent Wood Waste Sediment (gray zone sediments)	1-ft cap of clean material to enhance natural recovery, if necessary.	Reduce deleterious effects on habitat.
Entire Site	Institutional controls such as land and water use restrictions	Prevent future human exposure to groundwater, soil and sediment exceeding protective levels.

Appendix A

SEPA Checklist and Determination

[To be provided]

Appendix B

Cost Estimates for Remedial Alternatives

Cost summary for nearshore NAPL remedies
Quendall Terminals Property - Renton, Washington

Item	Total Cost
Soil Treatment	**$4,065,835**
Mobilization/Site Preparation	$486,410
Quendall Pond	$1,882,452
Former May Creek	$808,765
North Sump	$908,208
DNAPL Recovery	**$954,567**
Mobilization/Site Preparation	$83,500
North Sump	$245,533
Quendall Pond	$0
Former May Creek	$245,533
Soil Cap	**$2,074,333**
Mobilization/Site Preparation	$63,500
Quendall Pond	$124,023
Former May Creek	$136,565
North Sump	$117,402
Still House	$386,556
Other Method B Exceedances	$1,244,291
Groundwater	**$972,402**
Biosparging	$648,652
Institutional Controls/Monitoring	$223,750
Sediment Remediation	**$8,947,542**
Mobilization/Site Preparation	$468,800
Remove/Recycle Wood Waste	$2,201,595
Gray Zone Capping (1-ft)	$1,452,830
Dredge Nearshore	$3,006,686
T-Dock Dredging	$1,817,829
Mitigation	**$762,000**
Wetland Replacement	$762,000
TOTAL COST	**$17,300,000**

Note: All individual cleanup task costs include 10 percent for engineering and a 15 percent contingency. No costs for conducting maintenance or monitoring are included in these cost estimates

Soil Treatment Volumes for treatment and stabilization are based on the probable DNAPL distribution from the Upland Constituents Memorandum (RETEC 1997) and the Sediment Quality Memorandum (RETEC 1997)

Capping: Does not include costs for removing and treating or disposing of surface soil and wood waste that may be unsuitable from a geotechnical perspective and require special handling because of construction.

Groundwater: Stabilization biosparging cost is based on the conceptual design proposed by Exponent. A detailed design may affect costs significantly.

Groundwater: Monitoring includes triggering of in-water compliance wells and biosparging systems based on compliance monitoring flowchart.

NEARSHORE NAPL REMEDY COST ESTIMATES

A - SOIL REMEDIATION

QUENDALL TERMINALS - RENTON

Material Handling Assumptions:	**Overburden**	**Impacted Volume**	**Surface Area**
Quendall Pond	6,910 cy	14,900 cy	34,300 sf
Former May Creek	7,605 cy	4,105 cy	38,780 sf
North Sump	13,740 cy	5,930 cy	32,260 sf
Still House	22,690 cy	20,010 cy	115,190 sf
			220,530 sf

Capping Area Assumptions:			
Total Area Exceeding Method B	1,200,000 sf		
DNAPL Areas to be Capped with clean fill	220,530 sf		
Area Covered by Development Features	600,000 sf		
Area to be Capped with 3 feet of Clean Fill	379,470 sf		
Cost Estimating Parameters & Methodology:			
Interest Rate	8.0%		
Soil Density (in situ)	1.40 tons/cy		
<u>Excavation and Backfilling</u>			
Mobilization	$50,000		
Excavation/Stockpiling	$8.00 per cy		
Excavation/Backfill Rate	1,000 cy per day		
Dewatering System Install	$10,000 per well		
Dewatering Treatment	$200,000 x (gpm/50)^0.5	$0.003 per gallon	
Dewatering Discharge to METRO	$0.006 per gal	carbon regen	
Temporary Steel Piling	$15 per sf		
Backfill and Compact On-Site Soil	$5.00 per cy		
<u>Capping</u>			
Mobilization	$50,000		
Asphalt Capping	$1.00 per sf	2.0% of capital cost	
Clean Fill Capping	$1.00 per sf	1.0% of capital cost	
Clean Fill Capping in DNAPL areas	$1.00 per sf	1.0% of capital cost	
Purchase and Deliver Clean Fill	$10.00 per ton		
<u>DNAPL Recovery - Bioslurry Trenching</u>			
Mobilization	$50,000 LS		
Trenching, Backfill	$40 per sf		
Sumps, Pumps, Piping, Controls, Installed	$20,000 each	10.0% of capital cost	
<u>Soil Treatment</u>			
On-Site Thermal Treatment	$100,000 mobilization, plus	$40 per ton	
Off-Site Incineration	$750 per ton		
<u>Institutional Controls</u>			
Public Education Program	$20,000 originally, plus	$1,000 per year	
Maintaining O&M Plans	$8,000 originally, plus	$800 per year	
Deed Restrictions	$5,000 originally		
<u>Analytical Costs per Excavation Area</u>			
Excavation Confirmation	$20,000 LS		
Soil Treatment QA	$10,000 LS		
<u>Engineering, Procurement & Construction Management</u>	12% of capital		
<u>Contingency</u>	15% of capital		

COST ESTIMATE FOR
SOIL TREATMENT - MOBILIZATION/SITE PREPARATION

EXCAVATION AND THERMAL

Dewatering Rate 50 gpm

Capital Items	Quantity	Units	Cost
Excavation and On-Site Treatment			
Mobilization	1	LS	550,000
Dewatering Treatment System, Purchase	1	LS	200,000
On-Site Thermal Treatment, Mobilization	1	LS	100,000
Institutional Controls			
Public Education Program	1	LS	20,000
Maintaining O&M Plans	1	LS	8,000
Deed Restrictions	1	LS	5,000
Direct Capital:			$383,000
Engineering, Procurement & Construction Management			45,960
Contingency:			57,450
Total Capital:			$486,410

Present Worth of Longer Term Operating Costs	Years	Annual	Cost
Institutional Controls			
Public Education Program	30	1000	11,258
Maintaining O&M Plans	30	800	9,006
Total Present Worth, Longer Term O & M Costs:			$20,264
Total Project Capital :			**$506,674**

COST ESTIMATE FOR
QUENDALL POND SOIL TREATMENT

EXCAVATION AND THERMAL Dewatering Rate 24 gpm

Capital Items	Quantity	Units	Cost
Excavation and On-Site Treatment			
Soil Excavation	21,810	cy	$174,480
Backfilling w/on-site Soil	21,810	cy	109,050
Dewatering System Install	8	well	80,000
Dewatering Treatment - Carbon Regen	1,507,507	gal	4,523
Dewatering Discharge	1,507,507	gal	9,045
Temporary Steel Piling	15,000	sf	225,000
On-Site Thermal Treatment	20,860	ton	834,400
Excavation Confirmation	1	LS	20,000
Soil Treatment QA	1	LS	10,000
Direct Capital:			$1,466,498
Engineering, Procurement & Construction Management			175,980
Contingency:			219,975
Total Capital:			$1,862,452
Total Project Capital:			**$1,862,452**

COST ESTIMATE FOR
FORMER MAY CREEK SOIL TREATMENT

EXCAVATION AND THERMAL

Dewatering Rate 32 gpm

Capital Items	Quantity	Units	Cost
Excavation and On-Site Treatment			
Soil Excavation	11,710	cy	$93,680
Backfilling w/on-site Soil	11,710	cy	58,550
Dewatering System Install	8	well	80,000
Dewatering Treatment - Carbon Regen	1,079,194	gal	3,238
Dewatering Discharge	1,079,194	gal	6,475
Temporary Steel Piling	9,000	sf	135,000
On-Site Thermal Treatment	5,747	ton	229,880
Excavation Confirmation	1	LS	20,000
Soil Treatment QA	1	LS	10,000
Direct Capital:			$636,823
Engineering, Procurement & Construction Management:			76,419
Contingency.			95,523
Total Capital:			**$808,765**
Total Project Capital:			**$808,765**

COST ESTIMATE FOR
NORTH SUMP SOIL TREATMENT

EXCAVATION AND THERMAL

Dewatering Rate 34 gpm

Capital Items	Quantity	Units	Cost
Excavation and On-Site Treatment			
Soil Excavation	19,670	cy	$157,360
Backfilling w/on-site Soil	19,670	cy	98,350
Dewatering System Install	8	well	80,000
Dewatering Treatment - Carbon Regen	1,926,086	gal	5,778
Dewatering Discharge	1,926,086	gal	11,557
On-Site Thermal Treatment	8,302	ton	332,080
Excavation Confirmation	1	LS	20,000
Soil Treatment QA	1	LS	10,000
Direct Capital:			$715,125
Engineering, Procurement & Construction Management:			85,815
Contingency:			107,269
Total Capital:			$908,208
Total Project Capital:			**$908,208**

COST ESTIMATE FOR
SITE CAPPING

MOBILIZATION/SITE PREPARATION

Capital Items	Quantity	Units	Cost
Mobilization	1	LS	$50,000
Direct Capital:			$50,000
Engineering, Procurement & Construction Management:			6,000
Contingency:			7,500
Total Capital:			$63,500
Total Project Capital:			**$63,500**

QUENDALL POND - Excavation and Thermal

Capital Items	Quantity	Units	Cost
Cap with 3ft of clean fill	34,300	sf	$34,300
Purchase and Deliver Clean Fill	3,811	cy	$53,356
Capping QA/QC	1	LS	10,000
Direct Capital:			$97,656
Engineering, Procurement & Construction Management:			11,719
Contingency:			14,648
Total Capital:			$124,023
Total Project Capital:			**$124,023**

COST ESTIMATE FOR
SITE CAPPING

FORMER MAY CREEK - Excavation and Thermal

Capital Items	Quantity	Units	Cost
Cap with 3ft of clean fill	38,780	sf	$38,780
Purchase and Deliver Clean Fill	4,309	cy	$60,324
Capping QA/QC	1	LS	10,000
Direct Capital:			$109,104
Engineering, Procurement & Construction Management			13,093
Contingency:			16,366
Total Capital.			**$138,563**
Total Project Capital:			**$138,563**

COST ESTIMATE FOR
SITE CAPPING

NORTH SUMP - Excavation and Thermal

Capital Items	Quantity	Units	Cost
Cap with 3ft of clean fill	32,260	sf	$32,260
Purchase and Deliver Clean Fill	3,584	cy	$50,182
Capping QA/QC	1	LS	10,000
Direct Capital:			$92,442
Engineering, Procurement & Construction Management:			11,093
Contingency:			13,866
Total Capital:			$117,402
Total Project Capital:			**$117,402**

COST ESTIMATE FOR
SITE CAPPING

STILL HOUSE

Capital Items	Quantity	Units	Cost
Cap with 3ft of clean fill	115,190	sf	$115,190
Purchase and Deliver Clean Fill	12,799	cy	$179,184
Capping QA/QC	1	LS	10,000
Direct Capital:			$304,374
Engineering, Procurement & Construction Management:			36,525
Contingency:			45,656
Total Capital.			$386,556
Total Project Capital :			**$386,556**

REMAINDER OF METHOD B EXCEEDANCE AREAS

Capital Items	Quantity	Units	Cost
Cap with 3 feet of Clean Fill	379,470	sf	$379,470
Purchase and Deliver Clean Fill	42,163	cy	$590,287
Capping QA/QC	1	LS	10,000
Direct Capital:			$979,757
Engineering, Procurement & Construction Management:			117,571
Contingency:			146,964
Total Capital:			$1,244,291
Total Project Capital :			**$1,244,291**

COST ESTIMATE FOR
DNAPL RECOVERY

MOBILIZATION/SITE PREPARATION

Capital Items	Quantity	Units	Cost
Mobilization	1	LS	$50,000
Direct Capital:			$50,000
Engineering, Procurement & Construction Management:			6,000
Contingency:			7,500
Total Capital:			$63,500
Total Project Capital :			**$63,500**

COST ESTIMATE FOR
DNAPL RECOVERY

FORMER MAY CREEK

Capital Items	Quantity	Units	Cost
Trench Construction	3,750	sf	$150,000
Soil Treatment	583	ton	$23,333
Sumps, Pumps, etc.	1	ea	20,000
Direct Capital:			$193,333
Engineering, Procurement & Construction Management:			23,200
Contingency:			29,000
Total Capital:			$245,533
Total Project Capital :			**$245,533**

NORTH SUMP

Capital Items	Quantity	Units	Cost
Trench Construction	3,750	sf	$150,000
Soil Treatment	583	ton	$23,333
Sumps, Pumps, etc.	1	ea	20,000
Direct Capital:			$193,333
Engineering, Procurement & Construction Management:			23,200
Contingency:			29,000
Total Capital:			$245,533
Total Project Capital :			**$245,533**

NEARSHORE NAPL REMEDY COST ESTIMATES

B - SEDIMENT REMEDIATION

QUENDALL TERMINALS - RENTON

Material Handling Assumptions:	**Dredge Volume**	**Fill Volume**
T-Dock	12,400 cy	12,400 cy
Nearshore PAH/NAPL Sediment (including up to 6 ft in seep areas)	21,480 cy	21,480 cy
Wood Waste	48,200 cy	0 cy
Gray Zone	104,300 cy	0 cy
CDF Wall		25,000 cy
Nearshore Containment (0.5 acres)		20,000 cy
Gray Zone Capping (1-foot thick)		52,200 cy

Sediment Density - After dewatering	1.40 tons/cy		
Wood Waste Density	1.00 tons/cy		
Gray Zone Density	1.20 tons/cy		
<u>Mechanical Dredging</u>			
Initial Moisture Content (% mass - PAH on	55%	Woodwaste/Gray Zone	60%
Moisture Content After Barge	50%		
Moisture Content After Dewatering	30%		
<u>Hydraulic Dredging</u>			
Initial Moisture Content (% volume)	90%		
Moisture Content After Dewatering	50%		
Cost Estimating Parameters & Methodology:			
Interest Rate	8.0%		
<u>Dredging - Mechanical</u>			
Mobilization - Equipment	$80,000 per dredge		
Mobilization - Silt Curtain	$35,000		
Mobilization - Watertight Barge	$110,000 ea		
Shift Rate (8 hours) - Dredging	$5,600 per shift		
Shift Rate (8 hours) - Offloading	$2,900 per shift		
Debris Sweep Wash System	$38,000		
Debris Sweep Area	5 acres		
Debris Sweep Rate	1 acres per shift		
Clean/Wood Waste Dredging & Offloading	1,325 cy per shift		
Clean/Wood Waste Dredge/Offload Shift R	$8,000 per shift		
Contaminated Dredging Rate	350 cy per shift		
Contaminated Upland Offloading Rate	500 cy per shift		
In-Water Thin Layer Filling Rate	1,000 cy per shift		
In-Water Bulk Filling Rate	1,500 cy per shift		
Average Water Generation Rate	25 gpm		
<u>Upland Management</u>			
Mobilization/Site Prep	$50,000		
<u>Mechanical Dredge Dewatering Cell</u>			
Dewatering Cell Construction	$2 per sf		
Soil Holding Time	3 days		
Soil Stockpile Height	3 feet		
<u>Hydraulic Dewatering Cell</u>			
Primary Pond Size	6 acres		
Secondary Pond Size	0.75 acres		
Approximate Berm Length	2768 feet		
Berm Height	8 feet		
Berm Slope	2 :1		

Berm Soil Volume (8 foot crest width)	19,683 cy		
Mechanical Dewatering	$50 per cy		
Dewatering Treatment	$200,000 x (gpm/50)^0.5	$0.003 per gallon	
Water Discharge to METRO	$0.006 per gal	carbon regen	
Upland Handling	$5 per cy		
Excavation - Baxter Cove	$10 per cy		
Backfilling and Compaction	$7 per cy		
Dredging - Hydraulic			
Mobilization - Equipment	$121,000 per dredge		
Mobilization - Silt Curtain	$113,000		
Shift Rate (8 hours)	$3,800 per shift		
Dredging Rate (Soil)	240 cy per shift		
Average Water Generation Rate	2,000 gpm		
Sediment Treatment			
On-Site Thermal Treatment	$100,000 mobilization, plus	$40 per ton	
Off-Site Thermal Treatment, incl. transport	$4,500 setup/profiling +	$45 per ton	
On-Site Recycling of Wood Waste	$12.00 per cy		
Natural Recovery Monitoring	$38,000 per year	$21,000 sampling/analytical	
		$7,000 QA/Reporting	
		$10,000 SPI Camera	
Analytical Costs			
Dredge Monitoring	$20,000		
Sediment Treatment QA	$20,000		
Engineering, Procurement & Construction Mgmt	12% of capital		
Contingency	35% of capital		
Contractor Overhead/Profit	15% of capital		

COST ESTIMATE FOR

MOBILIZATION/SITE PREPARATION - MECHANICAL DREDGING

Capital Items	Quantity	Units	Cost
Upland Mobilization/Site Prep	1	LS	$50,000
Dewatering Cell Construction	54,000	sf	$108,000
Water Tighten Barges	3	ea	$330,000
Direct Capital:			$330,000
Engineering, Procurement & Construction Management:			39,600
Contingency:			49,500
Contractor Overhead/Profit:			49,500
Total Capital			$468,600
Total Project Capital Cost:			**$468,600**

COST ESTIMATE FOR

REMOVE/RECYCLE WOOD WASTE

Capital Items	Quantity	Units	Cost
Pre-Dredge Debris Sweep			
Mobilization	1	ea	$115,000
Water Tighten Barges	1	ea	$110,000
Debris Sweep Wash Area	1	ea	$38,000
Dredging	5	acres	$28,000
Offloading	1	LS	$14,000
Dredging			
Mobilization	1	ea	$115,000
Dredging/Offloading/Screening	48,200	cy	$291,019
Dredge Monitoring	1	LS	$20,000
Upland Management			
Upland Handling	48,200	cy	241,000
On-Site Recycling	48,200	cy	578,400
Direct Capital			$1,550,419
Engineering, Procurement & Construction Management			186,050
Contingency:			232,563
Contractor Overhead/Profit:			232,563
Total Capital:			**$2,201,595**
Total Project Capital Cost:			**$2,201,595**

COST ESTIMATE FOR
GRAY ZONE CAPPING (1-ft)

Capital Items	Quantity	Units	Cost
Purchase Soil	73080	ton	730,800
Sediment Placement	52,200	cy	292,320
Direct Capital			$1,023,120
Engineering, Procurement & Construction Management:			122,774
Contingency:			153,468
Contractor Overhead/Profit:			153,468
Total Capital:			$1,452,830
Total Project Capital Cost:			**$1,452,830**

COST ESTIMATE FOR

T-DOCK DREDGING AND TREATMENT

MECHANICAL

Capital Items	Quantity	Units	Cost
Dredging			
Mobilization	1	ea	$115,000
Dredging	12,400	cy	$277,760
Upland Offloading	12,400	cy	$71,920
Dredge Area Backfilling	12,400	cy	$35,960
Dredge Monitoring	1	LS	$20,000
Dewatering			
Water Treatment	1,040,487	gal	3,121
Treatment			
Upland Handling	12,400	cy	$62,000
On-Site Thermal	17,360	ton	694,400
Direct Capital:			$1,280,161
Engineering, Procurement & Construction Management:			153,619
Contingency:			192,024
Contractor Overhead/Profit:			192,024
Total Capital:			**$1,817,829**
Total Project Capital Cost:			**$1,817,829**

COST ESTIMATE FOR

NEARSHORE SEDIMENT SEEP EXCAVATION (6 ft below mud line) AND

DREDGING AND TREATING NEARSHORE PAH SEDIMENT

MECHANICAL

Capital Items	Quantity	Units	Cost
Dredging			
Mobilization	1	ea	$115,000
Dredging	21,480	cy	$481,152
Upland Offloading	21,480	cy	$124,584
Dredge Area Backfilling	21,480	cy	$62,292
Dredge Monitoring	1	LS	$20,000
Dewatering			
Water Treatment	1,359,346	gal	4,078
Treatment			
Upland Handling	21,480	cy	$107,400
Thermal	30,072	ton	1,202,880
	Direct Capital:		$2,117,386
	Engineering, Procurement & Construction Management		254,086
	Contingency:		317,608
	Contractor Overhead/Profit:		317,608
	Total Capital:		$3,006,688
	Total Project Capital Cost:		**$3,006,688**

COST ESTIMATE FOR

MITIGATION - WETLAND REPLACEMENT

Capital Items	Quantity	Units	Cost
Wetland Replacement	1	LS	$600,000
Direct Capital			$600,000
Engineering, Procurement & Construction Management			72,000
Contingency			90,000
Total Capital:			$762,000
Total Project Capital Cost:			**$762,000**

NEARSHORE NAPL REMEDY COST ESTIMATES

C-GROUNDWATER

QUENDALL TERMINALS - RENTON

Cost Estimating Parameters & Methodology:			
Interest Rate	8.0%		
Air Sparging Costs			
Air Sparging Wells, Piping, etc. (2" PVC x 30 feet)	$10,000	each	
Air Injection Flow Rate	5	CFM per well	
Air Injection Blower, Controls, Piping, Installed, Fix	$30,000	x (CFM/50)^0.6	6% of capital
Groundwater Extraction			O&M
Extraction Wells, Piping, etc. (6" PVC x 40 feet)	$25,000	each	
Extraction Rate	75	gpm	
Treatment System	$200,000	x (GPM/50)^0.5	10% of capital
Carbon Regeneration	$0.003	per gal	O&M
Water Discharge to METRO	$0.006	per gal	
Groundwater Monitoring			
Monitoring Wells	$7,000	ea	
Plans	$20,000		
Sampling and Analytical	$70,000	per year	
Reporting	$20,000	per year	
Institutional Controls			
Public Education Program	$20,000	originally, plus	$1,000 per year
Maintaining O&M Plans	$8,000	originally, plus	$800 per year
Deed Restrictions	$5,000	originally	
QA/QC	$50,000		
Engineering, Procurement & Construction Management	10%	of capital	
Contingency	15%	of capital	

COST ESTIMATE FOR
BIOSPARGING

EXCAVATE AND THERMAL

Capital Items	Quantity	Units	Cost
Air Sparging			
Mobilization	1	LS	$50,000
Air Sparging Wells	40	ea	$400,000
Air Injection Blower, Controls, etc	1	LS	$68,922
Direct Capital:			$518,922
Engineering, Procurement & Construction Management:			$1,892
Contingency:			77,838
Total Capital:			$648,652
Total Project Capital Costs:			**$648,652**

COST ESTIMATE FOR
INSTITUTIONAL CONTROLS AND MONITORING

Capital Items	Quantity	Units	Cost
Institutional Controls			
Public Education Program	1	LS	$20,000
Maintaining O&M Plans	1	LS	$8,000
Deed Restrictions	1	LS	$5,000
Groundwater Monitoring			
Wells	18	ea.	$126,000
Plans	1	LS	$20,000
Direct Capital:			$179,000
Engineering, Procurement & Construction Management:			17,900
Contingency:			26,850
Total Capital:			**$223,750**
Total Project Capital Cost:			**$223,750**

Appendix C

Restrictive Covenants

RESTRICTIVE COVENANT

CITY OF RENTON, QUENDALL TERMINALS

This Declaration of Restrictive Covenant is made pursuant to RCW 70.105D.030(1)(f) and (g) and WAC 173-340-440 by the City of Renton, its successors and assigns, and the State of Washington Department of Ecology, its successors and assigns (hereafter "Ecology").

A remedial action (hereafter "Remedial Action") occurred at the property that is the subject of this Restrictive Covenant. The Remedial Action conducted at the property is described in the following documents: 1) Prospective Purchaser Consent Decree, dated _____; and 2) Cleanup Action Plan, dated _____. These documents are on file at Ecology's Northwest Regional Office (NWRO).

This Restrictive Covenant is required because the Remedial Action resulted in residual concentrations of certain hazardous substances which exceed the Model Toxics Control Act Method A Residential Cleanup Level for Soil established under WAC 173-340-740, as described in the RI/FFS for Quendall Terminals dated _____.

The undersigned, the City of Renton, is the fee owner of real property (hereafter "Property") in the County of King, State of Washington, that is subject to this Restrictive Covenant. The Property is legally described as:

> That portion of Government Lot 5 in Section 29, Township 24 North, Range 5 East, W.M., and shoreland adjoining lying westerly of the Northern Pacific Railroad right of way and southerly of a line described as follows:
>
> Beginning at the quarter corner on the south line of said Section 29; thence North 89°58'36" West along the South line of said Lot 5, 1113.01 feet to the westerly line of said Northern Pacific Railroad right of way; thence North 29°44'54" East 849.62 feet along said right of way line to a point hereinafter referred to as Point A; thence continuing North 29°44'54" East 200.01 feet to the true point of beginning of the line herein described; thence South

56°28'50" West 222.32 feet to a point which bears North 59°24'56" West 100.01 feet from said Point A; thence North 59°24'56" West to the inner harbor line and the end of said line description;

Also that portion of said Government Lot 5 lying southeasterly of Lake Washington Boulevard, westerly of secondary State Highway Number 2A and northwesterly of the right of way of public State Highway Number 1 as established by deed recorded under Recording No. 5687408.

Situated in the County of King, State of Washington.

The City of Renton makes the following declaration as to limitations, restrictions, and uses to which the Property may be put and specifies that such declarations shall constitute covenants to run with the land, as provided by law and shall be binding on all parties and all persons claiming under them, including all current and future owners of any portion of or interest in the Property (hereafter "Owner").

Section 1. The Owner shall not alter, modify, or remove any impervious surfaces required by the Cleanup Action Plan in any manner that may result in the release or exposure to the environment of contaminated soil or create a new exposure pathway without prior written approval from Ecology. However, maintenance of the cap may be permitted without notice to Ecology so long as appropriate health and safety protocols are followed. In addition, excavation or other activities connected with site development are permitted so long as appropriate health and safety protocols are followed, a cap of equivalent protectiveness as required by the Cleanup Action Plan is provided following development, and Ecology approves the excavation or activity, which approval shall not be unreasonably withheld.

Section 2. Any activity on the Property that may interfere with the integrity of the Remedial Action and continued protection of human health and the environment is prohibited.

Section 3. Unless authorized by the Cleanup Action Plan or this Restrictive Covenant, any activity on the Property that may result in the release or exposure to the environment of a hazardous substance that remains on the Property as part of the Remedial Action, or create a new exposure pathway, is prohibited without prior written approval from Ecology.

Section 4. Unless authorized by the Cleanup Action Plan, the Owner will not withdraw groundwater from the Property.

Section 5. Access shall be restricted and appropriate signs posted to prevent swimming or direct contact with sediments at the Property.

Section 6. The Owner of the property must give thirty (30) day advance written notice to Ecology of the Owner's intent to convey any interest in the Property. No conveyance of title, easement, lease, or other interest in the Property shall be consummated by the Owner without adequate and complete provision for continued monitoring, operation, and maintenance of the Remedial Action.

Section 7. The Owner must restrict leases to uses and activities consistent with the Restrictive Covenant and notify all lessees of the restrictions on the use of the Property.

Section 8. The Owner must notify and obtain approval from Ecology prior to any use of the Property that is inconsistent with the terms of this Restrictive Covenant. Ecology may approve any inconsistent use only after public notice and comment.

Section 9. The Owner shall allow authorized representatives of Ecology the right to enter the Property at reasonable times for the purpose of evaluating the Remedial Action; to take samples, to inspect remedial actions conducted at the property, and to inspect records that are related to the Remedial Action.

Section 10. The Owner of the Property reserves the right under WAC 173-340-440 to record an instrument that provides that this Restrictive Covenant shall no longer limit use of the Property or be of any further force or effect. However, such an instrument may be recorded only if Ecology, after public notice and opportunity for comment, concurs.

CITY OF RENTON

By: _____
Its: _____

Dated this ___ day of _____, 1999.

ATTEST:

By: _____
City Clerk

APPROVED AS TO FORM:

By: _____
City Attorney

STATE OF WASHINGTON)
) ss.
COUNTY OF _____)

I certify that I know or have satisfactory evidence that _____ is the person who appeared before me, and said person acknowledged that he/she was authorized to execute the instrument and acknowledged it as _____ of the City of Renton to be the free and voluntary act and deed of such party for the uses and purposes mentioned in this instrument.

DATED: _____

_____
(Signature of Notary)

_____
(Print or stamp name of Notary)
NOTARY PUBLIC in and for the State of Washington, residing at _____
My Appointment Expires: _____